THE

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ELECTRICAL REVIEW.

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THE MINIMUM—AND AFTER.

THE great coal strike is ended, by order of the Council of the Miners' Federation, and by the time this issue is in the hands of our readers we hope most of the miners will have returned to work, in spite of their ballot vote being in favour of continuing the strike. The leaders, indeed, saw the uselessness of continuing the war, and expected the miners' ballot to be in favour of the men accepting the Act: but, as the reverse actually happened, it was necessary to call a full meeting of delegates and to take a card vote, which resulted in a majority of 3 to 1 in favour of resumption of work, and consequently the men got orders to resume. The question naturally arises why the ballot of the men was ever taken, as, if the meeting on Saturday last could determine the matter by taking a card vote, clearly this could have been done over a week ago, and much valuable time saved. The truth is, of course, that the leaders wished to throw the onus of accepting the Act, without a money value being included, upon the men themselves, and thus to relieve themselves of any responsibility. It is, however, only a question of time when they will have to face a serious reckoning; and in the meantime it may be interesting briefly to review the position and what may be expected in the near future, because, far from settling the unrest in the coal trade, we believe the Minimum Wage Act will be the cause of greater friction between miners and owners than any of the old methods of settling disputes, which will now be superseded by the "District Wages Board."

In the first place, the actual cause of the strike, undoubtedly, was the working of the Eight Hours Act, which was passed by the Government practically at the dictation of a few Labour leaders, and which resulted in more men being employed to obtain practically the same output of coal as was obtained previously to the introduction of the Act. We have mentioned this before, and it is interesting to note that this fact is now admitted by Mr. Brace, one of the men's leaders, who stated a few days ago that the men had not been able to obtain such good wages since the passing of this Act as they did before. Naturally, if more men are to be employed to do the same amount of work for the same amount of wages, someone will have to go short, and the men begin to complain. In a word, the miners had been badly treated by their leaders, and to save their own skins they had to look out for some remedy. Hence the "abnormal place" question—which was always a convenient one for raising a dispute—was resurrected and placed upon a pedestal for all to see, but unfortunately for the leaders it would not bear investigation, and the owners were ready, as they always have been, to consider any machinery to overcome this difficulty. Failing in this, they next demanded the minimum daily wage for all underground workers, telling miners that what was

wanted in addition to the Eight Hours Act was a fixed daily wage, and persuaded the individual that all he had to do was to strike for it. The men were asked to vote for the *principle* of a minimum wage, and many of them imagined that the *principle* really meant the 6s. to 7s. 6d. per day, according to the district; further, the majority of the men believed they would get this wage *irrespective of the amount of work they did*. This may seem incredible but it is true nevertheless, and the ordinary acceptance of the meaning was tritely given by the Northumberland pitman who explained: "The minimum wage is for gannen doon th' pit, and if he dis ony work he gets mair." Hence it appealed to the good workman as well as the poor one, for, as Lord Furness has already pointed out, if the poor workman were to get 6s. or 7s. per day, naturally the better workman would expect his earnings increased by a corresponding amount; and the result was the strike which has just ended.

Then came the period of negotiations between the Government and the Labour leaders, for it must be noted that all through the conferences the owners only received bare courtesy, and had finally to break off negotiations in absolute disgust when Mr. Smillie brought forward his famous *dicta* of 5s. 9d. and 3s. in place of what had become known—and was almost, we believe, agreed upon—as the 5 and 2 minima, the former being the 5s. datal wage for men and the latter the 2s. datal wage for boys of 14 years of age. That the Government did the right thing in trying to bring the two parties to an agreement no one, we imagine, will deny, but undoubtedly a great error of judgment was made in truckling to the demands of the Labour Party, at the expense of the owners and the community at large, by bringing in a Bill to enforce a minimum wage; in the opinion of many, which we share to a large extent, had it not been for this promise the strike would probably have ended sooner. There is, we think, now no doubt but that the great majority of miners fully believed that the scheduled rates of the districts for coal-getters would be included in the Bill. As it is, they have obtained nothing; or rather, they have obtained what they voted for, the *principle* of a minimum wage, which may mean anything. One thing, however, is certain: the trouble, far from being removed, will be very considerably enhanced when the district boards are set up and begin proceedings, as, whatever decision may be come to, there is little likelihood that it will suit the miners, and the owners are disgusted with the Act, owing to the omission—in spite of the definite promise of the Government to the contrary—of adequate safeguards against abuse by the miners. It was this very point which prevented the Federated Owners' and Miners' Associations from coming to an agreement long ago; yet the Government had so little confidence in themselves that they dared not make it part of the measure. Another point of dispute is the amendment introduced by Mr. Buxton in Clause 2, setting forth an instruction that the Joint Boards shall have regard to the *average* daily rate of wages in settling the minimum for any class of workmen. The Government promised the owners that the words would be "the *prevailing* daily wage rate," which is a vastly different thing to the average rate; but, as the miners' leaders would not agree to this, it could not be inserted. For instance, if a miner under present circumstances can only earn, say, 4s. per day, unless the minimum is below this there will be no incentive to this man to work at all; and supposing the minimum is 6s., the man who, on most days, earns little more than this has the incentive to relax his efforts and be content with the minimum of which he is assured. In these circumstances we may assume the management will dispense with the 4s. per day workman, as his employment would mean on a 6s. minimum a loss of 2s. per day; for otherwise, once a principle like this held sway, there would be an end to profitable industry.

It may be taken, therefore, as a foregone conclusion that whatever minimum may be decided upon in any district, any workman who at present fails to reach that minimum will either be dismissed by the management or will have to have his case specially considered by the District Board, and a special rate made to suit his individual case, and this will lead to endless strife and dissatisfaction, as undoubtedly the Union officials will do all they possibly can to enforce the payment of the minimum average rate.

The worst feature to be feared, however, of the "average" minimum wage is the demoralising effect upon the majority of fair workmen, who may not think it worth their while to put sufficient effort into their work to secure something more than the minimum, and who will become mere day-wage men instead of pieceworkers; this will react upon the community at large, as undoubtedly the output will decrease, the cost of production may enormously increase, and the selling price of coal will be considerably higher than it has been in the past. So far as we can see the Bill will benefit no one, and least of all the miner himself.

"Coalite." It is not often that the shareholders in any company are treated to such a frank and unvarnished statement of its financial affairs as that presented by Mr. James Todd to the shareholders of the British Coalite Co. on Tuesday, March 27th, on the occasion of the adjourned general meeting, at River Plate House, Finsbury Circus. The chairman had to announce to the shareholders that the company, which was founded in 1907 with a nominal capital of £2,000,000, and a subscribed capital of £580,000, had lost between £444,496 and £552,212 of the latter sum, as a result of the past four years' operations, the details of expenditure being as follows: Plant and buildings, £218,591; formation expenses, £85,809; debenture issue and discounts, £13,190; loss on operation of plant, £129,905; total, £444,496; to which must be added a contingent liability of £107,715 if a compulsory realisation of the company's assets should occur. Those who favoured the compulsory winding-up of the company were defeated at the adjourned annual meeting held in July, 1911, the board being of opinion that it would be wiser to wait a little longer before taking this drastic action. The present chairman naturally made some very scathing remarks upon the past management of the company's affairs, and declined all responsibility for the present position. The formation expenses of £85,809, and cost of debenture issue £13,190 (equal to 17½ per cent. of the principal sum received), show that there was a scandalous transfer of fees and commissions to the pockets of promoters, underwriters, and "experts," in the early stages of this company's history, and that the remarks made in our article of October 7th, 1910, upon "Coalite Management and Finance," were thoroughly justified. Drastic reforms are now in progress, but it is doubtful whether they are not too late.

The Board of the company have cut down the adminis-

trative expenses to £500 per annum; the directors are at present drawing no remuneration, and are simply waiting for the results of the extended trials with an improved process which is being financed by a subsidiary company, the "Eticoal Syndicate," before deciding whether to wind up the British Coalite Co. or to continue its operations. This syndicate has taken over the plant at Barking, and it is stated that from September until the middle of January (when the threatened coal strike caused some difficulties) the operations were continued at a profit, 60 per cent. of the coal put into the retorts being delivered, as against 40 per cent. by the original "Coalite" process We shall be only too pleased if the new process realises the hopes of the Board, and serves to rehabilitate the company. Our criticism has been directed, not against "Coalite" or any other smokeless fuel, but against the excessively bad management and finance that have marked the history of the British Coalite Co. We are glad to see that Mr. Thomas Parker, the inventor of the process, cleared himself of all participation in the past mismanagement of the company's affairs at the meeting, and stated that he had never received any money for the patents, and had underwritten 10,000 shares, which he still held. He was re-elected a director of the company. Sir William Preece, the other director who retired this year, did not seek re-election, and we are glad that he has at last severed his connection with this unfortunate company.

Gas Direct from the Coal Mine.

Sir W. Ramsay's suggestion, to cease coal mining and to fire the seams *in situ* and bring up the resulting products in the form of gas, is, no doubt, startling, but none the less interesting. There appears to be no impossibility in the operation, though there are many difficulties. To begin with, there is no limit to the thinness of the seams that can be worked. It would probably be deemed necessary to work or burn out the upper seams first, just as is done in ordinary present-day mining, where the lower seams, if worked before the upper ones, would cause so much shattering of the ground and of the upper coal, that this could not afterwards be got.

In order to gasify a seam of coal it would be necessary to start a fire and supply air down a shaft and draw the gas out by a second shaft. Were these two shafts at all near to each other, the admitted air might start an intense fire and produce complete combustion, only CO_2 being given off. Apparently what would be needed would be a central air-admission shaft, and on the borders of the area gas outlet shafts. Much preliminary work would be necessary. Headings would be required to enable the air to travel. The question is, would such air be properly converted to monoxide at a rational efficiency of conversion, not productive of too great a percentage of dioxide? Would the burned-out areas fall in and stop the travel of the air and gas? Would it be necessary to brick these air ways so as to ensure freedom up to a point, and, if so, how close together would such headings be necessary?

Again, would it be difficult to know if the whole of the coal had been burned out of a given area? And if not burned out, is such coal to be lost? Assuming it possible to carry out the scheme, the possibilities of economy are great. Lost areas of coal, too small to recover by present means, would become available. For dealing with small areas, mere small boreholes would suffice to admit air and give back gas.

At first thought it all sounds very simple, but on further study one encounters water difficulties. Water would effectually quench the great gas producers. How are the areas to be drained? Gas can be produced if the coal can be reached by air. It is true that when a seam of coal now gets afire, it appears to get air enough to keep it going for years at a more or less rapid rate. But the perversity of accidental fires always has been extraordinary, and difficult to understand to the man who has failed with the best of igniters to start a domestic fire, and it can hardly be anticipated that this perversity will not extend to a wished-for coal seam conflagration. Given that some such scheme of headings and a control shaft proved to be practicable, it is not impossible to agree that it might be practicable to control an underground fire. This desirable possibility would depend upon the maintenance of breathable air from the down-cast towards the fire area. With an uninterrupted flow of air from the downcast, the fire could be followed to any point by tunnelling towards it. We believe that the floor and roof of old mine drifts sometimes meet so closely as to destroy all passage-way, even for air. It is difficult to imagine how a burned-out seam can do otherwise than close up absolutely. If the fire would obligingly travel evenly after the manner of a "long-wall" system of getting, the roof might close up a few feet behind the fire face, and all would be well.

The subject is one that admits of a vast amount of engineering thought and speculation. Meantime, and pending a solution, would it not be well that engineers should look into the question of gas production about the base of the shaft? Coal, as got, could be converted into gas and would, so to say, lift itself to the surface by gravity difference, and at the surface the gas could be relieved of its by-products and used to generate electricity. This course is perfectly practicable, though it would not dispense with coal hewers, whom Sir W. Ramsay threatens with extinction. It is reported that the Ramsay system, as we will call it, is to be put to the test in a small pit in Wales, and the results will be awaited with interest.

The Compulsory Working of Patents.

It was always believed that the Act which compels a patentee to "work" his invention in this country as a condition of retaining his monopoly would give rise to some curious cases. Experience has shown that this belief was well founded. Certain facts which led to a recent decision by Mr. Justice Parker show how the Act might be made an engine of oppression to the unfortunate patentee, were it not that the Courts have a dispensing power. It appeared that in 1904, one Taylor obtained a patent for "Improvements in and relating to Mechanical Underfeed Stokers." In 1899 a patent had been obtained for a somewhat similar device known as Deeley's patent, which is now being worked in this country. In 1908 it was decided in the United States that Deeley's patent was the master patent, and that Taylor's patent could not be worked in that country without infringing Deeley's. In these circumstances, Taylor's patent had not been worked in England, and the proprietors of the master patent accordingly applied for the revocation of Taylor's on the ground that it was not being worked as required by Sec. 27. The Comptroller decided that Taylor's patent should be revoked. On appeal, Mr. Justice Parker pointed out that the onus was upon the proprietors of Taylor's patent to show sufficient reason why it should not be revoked. Those who applied for the revocation said that a compulsory licence ought to be applied for, to work their patent, but did not say that they would grant a voluntary licence. In these circumstances it was for the Court to say whether there was sufficient reason for not working. "The Court," said the Judge, "is bound to look primarily at the interests of the public. It is impossible to see what else the appellants could have shown in answer to the application for revocation. Without laying down any general rule, it must be said that in this case the non-application for a voluntary or compulsory licence is not a sufficient reason for revoking their patent, when nothing they could have done in the way of working the patent here could have been done without the risk of proceedings against them for infringement." In the event he made an order that the patent should not be revoked, without prejudice to any future application for revocation.

D

PASSENGER TRANSPORT.

The author of a long article in our contemporary the *Westminster Gazette* optimistically claims the whole field of passenger transport for internal-combustion engines. Particularising main-line railway working, he proceeds to embellish his claims and prophecies with a number of irrelevant statements and misstatements and numerous serious flaws of reasoning, meanwhile adopting a laxity and extravagance of language which, even in columns designed for lay perusal, is ill-suited to its subject.

The opening paragraphs idealise a 10 minutes' service to and from every centre of importance in the kingdom, and the consequent abolition of the time-table (which is much less of a worry to "every enterprising manager" than the author would have us believe). Passing over, for a moment, the absurdity of a 10 minutes' service on long-distance main lines, we are informed that electricity has been superseded by "a more agreeable and economical prime mover."

"And this new and economical power that railway directors and shipowners and the rest of the world whose interests are vested in commerce have been expecting and waiting so long for, has at length been discovered in the form of the latest developments of the internal combustion engine—that self-contained power in a nutshell device—which in the year 1912 brings us to the parting roads in power sources in its application for railway work."

Leaving this interesting statement to the mercy of our readers, we certainly cannot agree that the gas engine is replacing the steam engine "in every department where power is used"; a 3,000-H.P. gas engine still evokes as much interest as a 30,000-H.P. steam turbine, and, in the event of main-line electrification—at present or at any time in the reasonably remote future—internal-combustion engines would no more be used in preference to steam turbines than "the mammoth generators would go on supplying current just the same whether 50 or 500 trains were in use." (Comment on such heart-breaking ignorance as is exemplified by this gem is as unnecessary in these columns as protest seems, in any place, futile.)

We see no connection between the number of horse 'buses replaced by motor vehicles and the problems of railway working. The electrically-driven tramcar has certainly not "been beaten by the internal-combustion engined omnibus in the first years of its existence," and the future which the writer claims for motor-'buses will far more probably be realised by the electric trolley-'bus. In any case, main-line problems cannot be considered by reference to the conditions and results of highway transport. Questions of traffic-dodging, route-changing and passenger-landing do not arise in railway working, and, in place of vehicles of 5-10 tons weight, driven at 8-12 M.P.H. by 20-40 H.P. engines or motors and stopping every few hundred yards at most, we have, on main-line railways, to consider the propulsion of 300-600 tons at 50-70 M.P.H. (necessitating 800-2,000 H.P.), with many miles between stops.

Equally pronounced are the distinctions between the conditions of suburban and main-line operation—a point which the *Gazette* writer apparently fails to realise. It is safe to prophesy that city and suburban railways can never be worked by internal-combustion engines, for, though a satisfactory transmission between the engine and driving wheels were obtained, it would still be necessary to provide on each locomotive that enormous, temporarily-required accelerating power which is so readily provided by the central station in electrical schemes.

Main-line conditions—long-distance runs at fairly constant speed—are essentially favourable to working by self-contained locomotives; but, even here, Continental experience has proved the great practical advantages of electrical operation. The capital cost of electrification is admittedly high, but the efficiency of service is greatly enhanced, and the overall working costs are greatly reduced. Internal-combustion engines of a size and form suited to main-line requirements have still to be evolved, and, even for small powers, the problem of providing a variable-speed-and-power transmission, comparable in simplicity and efficiency with those used by steam and electric locomotives, has yet to be solved. The capital cost of replacing steam by gas or oil locomotives would be very considerable, and an exorbitant depreciation would have to be allowed on the engines, while there is no reason to suppose that the wear and tear on permanent way would be any less than under steam or electric operation.

The writer loosely speaks of the use of crude-oil fuel in internal-combustion engines without taking into account the great difficulty—indeed, present impracticability—of utilising such material in engines suitable for traction work. This being so, he appears to have burnt his boats by the candid admission that "petrol at 6½d.-7½d. per gallon is hardly a commercial proposition"! On economic and engineering grounds alike, there is not yet available an internal combustion engine capable of competing with steam or electric locomotives.

We fail to see why the fact that "electricity as a prime mover needs another prime mover" should involve the failure of electric main-line working. Electric generators are not "of themselves power-creating," but neither are internal-combustion engines; nor, indeed, anything under our control. Latent energy is available in coal, oil, and gas, and the use of a central station with engine-driven generators and transmission lines merely adds a few links to the chain of processes whereby this energy is applied to the driving wheels. The overall efficiency of the more involved procedure is so high, and the security of supply, reserve power capacity, and numerous incidental advantages, are such as to counterbalance the lower capital cost of all "self-contained" locomotives. "Our present railway development has been achieved with independent power units and not with central power stations," but it does not follow that the former arrangement is the more satisfactory.

Reverting to the proposal for a 10 minutes' service on main lines—which could, of course, *per se* be provided by trains of any length or by single coaches electrically operated, with full retention of the advantages of electrification—it is surely obvious that the scheme is ridiculous, in that it is totally unwarranted by traffic requirements. A person wishing to travel from London to Manchester is quite prepared to consult a time-table on the subject, and to arrange his plans to suit the railway service, in so far as the latter, arranged to meet the average requirements of the public, fails to suit his greatest convenience by an hour or two. The many conveniences of modern long-distance travel—dining cars, office compartments, and so on—could not possibly be provided on the vast number of single-coach or trailer trains which would be in service under the proposed scheme. Possibly speeds are to be so raised that there will be insufficient time to conduct correspondence or dine on long-distance journeys? Higher speeds than 100 to 120 M.P.H. are not likely to be employed on main-line railways, and, in any case, electric traction makes possible higher schedule speeds than are feasible by any other known means.

It is not so much at the ultimate possibilities of internal-combustion locomotives that we cavil as at the inference that their use on main lines is immediately pending, the omission to state clearly the many great difficulties to be surmounted and, above all, the grossly biased view taken of the prospects and characteristics of electric main-line traction.

Among the communications published from correspondents (mainly motor engineers), we find one looking forward to the use of 80,000-100,000-H.P. internal-combustion turbines in the near future. There is no harm in looking forward, but a basis of fact and reason is desirable. The opinions expressed are naturally favourable to the views of the original author, emanating as they do from enthusiasts of his own complexion, and most of them exhibit an equal lack of familiarity with the technical considerations which obtain in this connection. Almost the only serious opponent is Mr. A. H. Walton, who states the actual facts concisely and with moderation. Among other points, he emphasises the impossibility of substituting single coaches for long trains in suburban traffic, and the economy and elasticity of electric traction, while he exposes some of the fallacies and misstatements of fact contained in the articles. Mr. B. D. Fox also points out the inherent unsuitability of the internal-combustion engine for urban service by rail or road, and the great superiority of the electric motor supplied with power from a central station. Several of the other correspondents have their own axes to grind, and do this with zest.

FRAUDULENT TESTS.

[CONTRIBUTED.]

(*Concluded from page* 535.)

THE governor trials of an electric lighting set usually consist in increasing and diminishing the load on the plant, a quarter at a time, and finally in suddenly throwing on and off the full rated load of the machine. The essential object of these trials is to ensure that no undue change of voltage occurs with varying loads, although both the speed regulation of the engine and the compounding qualities of the dynamo are simultaneously involved. Suppose, in a certain case, that the voltage regulation is bad, the fault being attributable either to the engine governor or to the design of the dynamo; in order to get such a plant through its tests, a second rheostat is inserted in series with the ordinary field rheostat. The latter, of course, has to remain untouched throughout the proceedings, but the auxiliary rheostat is in charge of some ingenuous youth apparently busy with some other test. The attention of the inspector is concentrated on the voltmeter, and every time the load is changed the auxiliary rheostat is simultaneously jerked over a predetermined number of stops, thus neutralising the rise or fall of voltage which would otherwise occur. The programme needs rehearsal beforehand, but it has proved wonderfully effective with Admiralty inspectors. Engines have also been got through governor trials by surreptitious manipulation of the cylinder-cocks, but this is difficult to do undetected, and is generally too risky to attempt.

When undergoing its governor trials, the greatest danger of an engine failing to comply with the speed regulation guarantee occurs when the load is changed from zero to one-quarter full load and *vice versa*. This is because the ordinary type of throttle valve for a high-speed engine leaks considerably, and at small openings the uncontrollable leakage steam amounts to a fair proportion of the steam which the engine requires at light or zero load. To get an engine through this portion of its governor trials with credit, it is sometimes necessary to furnish it with a small extra load which is not indicated by the ammeter. Thus when the load is apparently changed from zero to one-quarter, it really is changed from one-quarter to one-half.

The fact that a tachometer can usually be adjusted to read either fast or slow is another thing that the inspector should never lose sight of, because sometimes this adaptability of the instrument is made use of. For instance, to obtain a good ratio between the indicated horse-power and the kilowatts generated, there is a temptation to run the engine faster than its apparent speed, thus making the indicated horse-power work out to less than it really amounts to, and so obtaining a spurious figure for the efficiency. A similar adjustment is occasionally useful when it is desired to increase the apparent speed at which an emergency run-away device comes into action. The engine speed is first reduced by the desired number of revolutions, the tachometer screwed up to indicate the normal speed, and the field rheostat adjusted to bring back the voltage to that specified. All is then ready for the inspector to carry out the emergency test.

In briefly reviewing a few of the tricks practised upon inspectors of plant, the writer has mentioned none except some of those which he has actually known to be carried out, or which he has heard of from unimpeachable sources. No doubt any experienced tester could add to the list, as, given reasonable ingenuity and nerve, suitable conditions, and an average inspector, all things are possible. The blame for the vast amount of fraud that goes on must be divided about equally between the firms who profit by it and the inspectors who permit it. The natural temptation on the part of the former, to acquire an unwarranted certificate of excellence for their plant, is encouraged by the incompetence or laxity of the inspecting officer. There is no inducement for a firm of engine builders to strive after efficiency, when even the Admiralty authorities are content to accept steam consumption figures obtained by dipping a graduated stick into a more or less rectangular tank of reputed capacity, into which the air pump discharges, and of which the outlet is invisible. Under the same system of inspection, steam consumption tests have been run month after month without its ever being noticed that a standing turbine was also connected to the condenser, and, of course, robbed the measuring tank of as much water as the turbine casing and exhaust branch could hold. The writer has also been told of Admiralty engineer officers spending days in altering the setting of a slide valve in order to cure an engine of vibration. Even a premium pupil could have told them that the steam distribution in the cylinders could have no more to do with the trouble than the colour of the paint.

In spite of their comparative inexperience, some of the younger inspectors would, no doubt, discover many cases of fraud, had they any object to gain in doing so. But the fear of "giving themselves away" by showing an apparently unfounded suspicion deters them no less than a misgiving as to the effect of annoying a firm having powerful "friends at court." And so the game goes on, and no doubt will continue to do so.

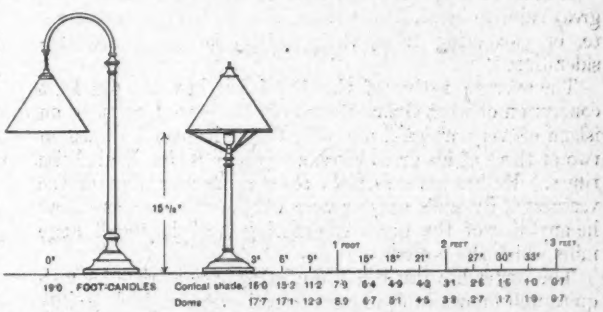
SOME NOTES ON TABLE STANDARDS.

[CONTRIBUTED.]

PORTABLE fittings on an office table are often a great nuisance, and the flexible to them is a greater one, but they provide such a cheap and simple means of either supplementing or dispensing with the general lighting, that there are many places where they have to be installed.

A glance through any fittings catalogue will show that table standards may be divided into two classes—the erect and the inverted, the proportions listed being, roughly, six of the first to every one of the second type. This proportion seems directly opposed to their respective desirabilities from a lighting point of view, but is accounted for, no doubt, by the simplicity of construction of Type 1 and its smaller height.

As users of metal-filament lamps are aware, no such lamp (unless of very low voltage) can long withstand the constant jarring to which it is subjected in a portable fitting, so that the old, inefficient, carbon filament has to be retained for table standards. With standards of Type 2, however,



the lamp life is lengthened considerably, especially when the arching top is not of too stiff tubing, and when the lampholder hangs from it by a few inches of flexible. A filament which fails almost immediately from the trembling of a rigid support will survive a quite marvellous amount of violent, but free, swinging.

But there is another point on which the second type has the advantage—the gain of 6 in. of the most brilliantly lighted area, as is evident from the accompanying sketch. The readings for this were taken under ordinary working conditions, *i.e.*, not in a blackened laboratory, but in an ordinary office (whose ceiling was white several years ago), with the standard surface laid flat on the table—not inclined so as to be always at right-angles to the rays of light. A carbon lamp of nominally 16 C.P. was used under a green-backed opal shade, 10 in. × 5½ in.

It might be thought that there would be some difference in the light obtained owing to the reversal of the position of the lamp under the shade in the pendant type, but a number of measurements proved this (apart from the shadow of the spider) to be negligible; this is due to the fact that the direct rays bear but a small proportion to the reflected rays illuminating the table.

This point is brought out very clearly by substituting a

10-in. × 4½-in. dome shade (also of green-backed opal), when, with the same fitting, and the lamp consequently at the same height above the table, the illumination is materially increased—except at the extreme radius of effective lighting. Although part of this may be due to the greater efficiency of the concave reflector, much of it results from the apex of the shade being an inch nearer the surface of the table, which conclusion is borne out by the falling away in illumination at a distance of 3 ft., where the angle of incidence would be proportionately less.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A RECENT report published by the Department of Railways and Canals on the subject of telephones shows that there are in Canada more than 537 telephone companies with a combined capital of something over £8,000,000. Three provinces viz., Manitoba, Alberta and Saskatchewan have Government telephones. In the last-named there are still many companies operating, but in the former two all telephones are controlled by the Government. Telephones are in much more common use here than at home, although the rates charged are by no means low, possibly the severe winters partly account for this.

The writer of these notes was very glad to see the recent editorial in the REVIEW on "The desire of the Britisher abroad." In spite of the very decided vote of Canadians against "Reciprocity" with the U.S.A., which was recorded last September, there are many people here, including engineers, who have very little regard for Canada's connection with "Home." Canadian-born engineers, in very many cases, receive a good part of their training in the United States, and return here imbued with a due sense of the greatness of that country combined with not a little contempt for Great Britain and her sons.

It must be borne in mind that the Americans take very great pains to inculcate the idea that anything not pertaining to, or emanating from, their country is not worth consideration.

The average native of the Dominion has not the least conception of what Great Britain is like—to him it is an island of very insignificant size, which he could drown in two or three of his great lakes, and which is far behind the times. He has never seen the sea and has no notion of the vastness of Britain's navy or mercantile marine, neither knows he anything of the great engineering workshops and huge mills which she possesses.

The writer has just received a letter from a friend, a man quite well known in the Manchester district, of high ability and refinement, and possessing a splendid technical training, who has recently come out here, in which he indicates that he at any rate finds that some Canadians are inclined to treat an Englishman with contempt, as something decidedly inferior to themselves. This is not as it should be and though there are signs that, owing to the large numbers of well-educated Britishers now coming over here this idea will be gradually dispelled, it were well that, if possible, concerted action be taken both here and at home with that object in view. So far as electrical engineers are concerned the proposed formation of a Canadian section of the I.E.E. would certainly be of assistance if taken up in a proper and determined manner. The word determined is used advisedly, as there is little doubt that, for some time, such a section would have to struggle for existence, and would probably receive but little support from any except British engineers, and not in all instances from even these as, for want of any other electrical engineering society, many of them are, perforce, already members of the local branches of the American I.E.E. If anything can be done, it should be done at once, and that thoroughly, in no half-hearted fashion. In 10 years' time the formation of a Canadian Section of the I.E.E. will be more difficult than at present, and the branches of the American Institute will be much more numerous and influential. At the moment of writing the Canadian branches of the Am.I.E.E. are appointing committees to consider the question of standards. These standards are, of course, those formulated by the parent section in the U.S.A. Some of them, no doubt, are international ones, but the fact that the request to consider the standards comes from the States, and that many of the standards are purely American, does not help Great Britain much or tend to advertise her wares. A remark made a day or two ago to the writer by a prominent electrical engineer, of Canadian birth, is somewhat significant in this connection. It was to the effect that, though he did not like the idea of standards being called "United States standards," if adopted by both countries, as they would belong to Canada as well, he saw no objection to their being called *American* standards; but one might well ask, who, that heard the latter term, would think of Canada as a separate entity in relation to it? Once include Canada in the term America, and—well, hang her, like the proverbial dog, so far as Great Britain is concerned.

If British manufacturers wish to improve their trade connections with Canada, they must bestir themselves—the effort will be well worth it, but, as shown recently in these notes, from an electrical standpoint they stand, even now, a long way behind the U.S.A., and unless the matter be taken up in earnest, the "lag" will become rapidly greater.

One method which would tend to improve the trade relations between Canada and Great Britain, which suggests itself to the writer, is that the large manufacturers in the latter country should develop some scheme whereby it would be easy for Canadian graduates of technical schools and colleges to go over to receive a practical training in British workshops.

This would, in time, furnish Canada with numbers of young engineers whose attitude towards the mother country would be very different from what is generally the case now, and, being Canadian born, they would have more influence over here than those who are not natives of Canada. There may be difficulties and objections raised against this suggestion, but the fact that the graduates go now to the U.S.A. and return with ideas which are certainly not of such a character as to assist British manufacturers, coupled with the additional fact that American-born engineers come over here in large numbers to take up appointments, frequently some of the best, should make it worthy of more than passing notice.

Canada's position, as pointed out in the editorial already referred to, is unique owing to her geographical position relatively to the U.S.A. and to Great Britain. While much nearer home than the other Colonies she is, at the same time, much nearer to a powerful trade rival, who already has the whip hand, and means to keep it.

Too gloomy a view of the situation, however, must not be taken, for, in spite of all that has been said, Canada has strong leanings towards the Mother Country, and, if British firms will but try, much lost ground may be recovered, and a very fair share of the rapidly-increasing trade may be secured.

To revert once more to the subject of a Canadian Section of the I.E.E., a nucleus might be formed from the representatives of firms who have come over here, being in close and constant touch with the home-land, and working for her interests. It would surely be a pleasure to them to feel that they had still another link binding them to her.

That a way may soon be found for the formation of such a section is the sincere wish of the writer of these notes, who would gladly do all in his power to further the carrying out of the idea.

Mazda Lamps at the Bottom of the Sea.—We understand that the P. and O. steamship *Oceana*, which foundered recently in collision with a sailing vessel, was taking a large consignment of Mazda drawn-wire lamps to Bombay. These lamps were intended for use in the Bombay Town Hall, and in consequence of the total loss of the *Oceana*, a repeat order has been placed with the British Thomson-Houston Co., Ltd.

Entertainment Houses and Electricity.—A correspondent writes:—"There is a big demand just now for complete electrical installations amongst the entertainment houses illuminated by gas. The strike has caused them great anxiety, many of them in the smaller towns having been compelled to close, owing to the supply running out."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Tests of Metal-Filament Lamps.

I have noted with interest the recent comments in the electrical papers, advertising columns and elsewhere, on the results of some comparative tests of metal-filament lamps, particularly as several manufacturers have claimed superiority for their lamps as a result of such tests, the interesting thing being that several manufacturers are using the same test, each claiming it to show his product to be the best.

I should like an opportunity of pointing out that there have been no published comparative lamp tests of the various makes of metal-filament lamps made thus far in England, which have been of any value.

Such comparative metal-filament lamp tests as have been made are insufficient, incomplete and inconclusive tests for the following reasons :—

1. The number of lamps tested is entirely too small to give any true indication of the average quality of the lamps. All lamp-testing experience shows the necessity of having a large number of lamps—at least 50 to 100 lamps for initial test readings, and at least 10 to 20 lamps of each make for life test.

2. The life tests have not been conducted on the proper basis. Such tests as have been conducted have been run at rated voltage, which results in some lamps being started at one efficiency and others at other efficiencies. The results have been published just as they have come out, without any corrections for differences in efficiency, all of which leaves the life and candle-power results incomparable. A true life and candle-power test of lamps requires that all lamps should be started at the same average initial efficiency, or, at least, that the results obtained be corrected to bring them to a basis of equal initial efficiencies. This point is totally neglected in tests so far conducted, giving inconclusive results and very misleading information.

When it is realised that a difference in initial efficiency of only ·05 watts per candle means one-third longer life for the lower efficiency lamp, and that the difference between 1·25 watts per candle and 1·35 watts per candle means a difference between 100 and 175 per cent. in life, and the difference between 1·25 watts per candle and 1·5 watts per candle multiplies the life by 4, it will readily be appreciated that the differences in initial efficiencies are extremely important, and results must be brought to a comparable basis of equal initial efficiency for any real determination of relative life value.

Lastly, the method of obtaining sample lamps from the manufacturers is open to strong objection, as these may be specially selected lamps. They should be the average product of the manufacturer, such as would be given if packages were purchased in the open market from the regular stock product.

These points are indisputable, and must be accepted by anyone familiar with the necessities for correct lamp testing. It is time, therefore, that attention should be directed to these matters so that there will be a proper understanding of what is necessary for complete and conclusive tests on lamps.

It is important that the full facts regarding lamp tests that have been conducted should be known and understood, so that the inconclusive results of such tests will not mislead lamp purchasers and users.

F. W. Willcox.

London, E.C., *March 30th*, 1912.

The Education of the Engineer.

I have before me a new book on "Power House Design," by John F. C. Snell. From page 10 of the book I copy the following passage :—

"*Feed Water Supply.*—If the geological strata are such as to provide not only a good foundation, but also a supply of good feed water through sinking an artesian well or a bore-hole, the site will be more valuable, since the cost of pumping such water is usually only one-sixth, or less than the cost of purchasing the water, and, moreover, dispenses with evaporating plant and reagent apparatus which would be necessary were brackish or salt water used from which the circulating water is obtained."

Some of your readers might like to amuse themselves by trying to find out what this means. I do not advise anyone to try to *parse* it.

Imagine one to have got as far as the "moreover dispenses" : he sets out to seek for the subject of the verb "dispenses." How long will it be till he gives up in despair ?

It would be a graceless performance to criticise line by line the English of a book that seems so likely to be valuable to the technical man. But the volume is the first of a new series ; the publishers are the great firm of Longmans. Surely they have someone about the house who is able to advise on the questions raised by a reading of the passage quoted above.

A Mere Irishman.

Irish Peat.

Mr. Tomlinson's ideas as to peat drainage are good and sound and would be quite applicable to many of the Irish bogs, which are so placed as to be drainable by gravity without unduly deep cutting out of the sides of the containing hollow in which the peat has grown. To the writer the Irish bogs as a rule appear to be ponds, the outlets of which have become choked by vegetable growth, and in this way the plant growth has risen to many feet above the land about, and drainage has had to take effect by numerous seepages all round the bog area.

The first care should be to find the probable old lake outlet, and clear this down to the valley before commencing to cut down the edge of the basin to the lowest level of the deposit. Probably this could not be done at once. The first work to be carried out would be surface drains, to be cut deeper and deeper as the water fell and the peat dried out. After the upper parts had dried to quarrying depth, this work could then commence while the drains were cut deeper. This would greatly simplify the drainage by removing the top weight. Subaqueous peat when kept undisturbed and left to dry is as hard as wood, and if quarried, as Mr. Tomlinson suggests, in big lumps, could, when dry, be cut to block size by sawing.

But are there not many bog areas which cannot be drained by any short drain to a near valley—areas of real lake country, below the general level, which cannot be cheaply treated by bottom drainage ? Would such areas be economically treated by mechanical reduction of the water-level over a period of years ? Would it pay to pump all the water, or would it pay to dredge the whole mass and deposit it on the nearest drainable area to dry out by gravity ?

Coal is very dear in Ireland, and the peat industry should pay as well as it does in Sweden or in Holland. Especially should it be commercially profitable to-day in view of the value of the by-products available where gas producers are used, and energy can be exported through wires to any point in the island. The "friends" of electricity in this country have done it a disservice by their frequent denunciation of the possibility of high-tension distribution. The man in the street does not see why high-tension leakage should be worse on a wet day in Great Britain than it is in Mexico or California, where it is quite moist when it rains. One would think it rained dust in Mexico, to hear some experts talk.

Mr. Tomlinson refers to an honest and alert public department to deal with Irish peat. Experience with "the Castle" does not encourage any hope of alertness from that quarter. The writer once tried to interest the Irish Government in a peat recovery system. Finding all endeavours hopeless, he applied for the return of his papers, but they were declared unfindable or as having never been received, or some such explanation was given. They were never recovered. One wonders if they were ever noticed further than being acknowledged. The "Castle" is hopeless to deal with. Let there be a regularly appointed Committee free from Castle influence, and with men of scientific and commercial ability at the helm ; something might then be done for Irish peat.

Simon.

THE INTERNATIONAL SMOKE ABATEMENT EXHIBITION AND CONFERENCE.

[BY OUR SPECIAL CORRESPONDENT.]

This Exhibition and Conference, preliminary details of which have already appeared in the Electrical Review, was opened upon Saturday, March 23rd, by the Duke of Argyll, in the presence of a large gathering of scientists and engineers, and closed last Saturday evening, after a very successful run.

The most notable feature of the opening speeches was the suggestion made by Sir William Ramsay, F.R.S., President of the British Association and the leading English chemist, that coal mining might soon be an unnecessary and decaying industry, gasification of coal in the pits, and the withdrawal of this gas for heating and power purposes, taking the place of the hewing and raising of solid fuel.

Although the majority of critics have dismissed the scheme as Utopian and impracticable, the suggestion really deserves consideration and trial. One speaker during the Conference proceedings, on March 27th, in fact, stated that a small coal mine which was fired accidentally in New South Wales some years ago was still burning, without any artificial aids to increase the air circulation or to prevent falls of roof. This fact seems to indicate that with a regulated air supply and artificial draught, the gasification of coal *in situ* is a perfectly feasible operation, especially in those cases where the natural stratification of the fuel-seams lends itself to this method of work. Sir William Ramsay has since announced that the new method will be tried experimentally at an English colliery during the current year. Since the proposal covers the use of gas for generating electricity at the mine, and distribution of this electricity over a wide area, electrical engineers will have a very keen interest in watching the development of Sir William Ramsay's suggestions.

The Exhibition embraced all classes of factory and domestic appliances for minimising or reducing smoke. As customary in all recent successful exhibitions of this character in the United Kingdom, the exhibits covered both gas and electrical apparatus, and those relating to household smoke rather overshadowed the exhibits relating to factory smoke. The combined displays of cooking and heating appliances made by the various metropolitan electricity and gas companies were, in fact, the most striking and artistic exhibits in the Hall.

In the joint exhibit by the London electric supply authorities and by various manufacturers of electrical apparatus, the latest methods of utilising electricity for lighting, heating and cooking purposes were displayed amidst very artistic surroundings, and one could indulge in an electrically-cooked meal, to the strains of a Russian orchestra. The writer sampled the viands at all refreshment places open to the visitors in the Exhibition (also one outside it), and he can truthfully say that the Electricity Hall was by far the best of the four. Whether this was due to the better management, or to the use of electricity for preparing the food, he does not presume to say.

As already stated, the exhibits of special interest to manufacturers were rather outclassed in attractiveness by these more popular shows; but the leading English makers of mechanical stokers, gas producers, and smoke-consuming devices were all represented. The international character of the Exhibition was maintained by the displays of the Compagnie Française des Brevets Schaller, of Paris; N. V. Hoek & Co., of the Hague, Holland; H. Kowitske & Co., of Berlin; Hjalmer Lofquist, of Stockholm; the Compagnie Russfang, of Hanover; the Treibel Smoke Combustion Co., of London; and Carl Zeiss, Ltd., of London.

Messrs. Bennis & Co., of Bolton, had their customary well-arranged exhibit of machine stoking and ash-handling plant. Two different methods of supplying coal to two types of mechanical stokers were demonstrated: the "Bennis" high-temperature smokeless and gritless coking stoker, fitted to an internally-fired boiler, and the "Bennis" new patent smokeless and gritless chain-grate stoker, fitted to a water-tube boiler.

A "Bennis" elevator, fitted with a rotary feed and special chain and buckets for boiler-house use, was shown elevating the coal to bunkers composed of riveted plates and supported on massive stanchions. Part of the bunker was provided with a hopper bottom, and fuel was fed direct from the bunker into the coking stoker. A shoot leading from the bunker fed the chain-grate stoker. The fuel thus fed into the stokers travelled along the bars, and after passing through the furnace was fed by a "Bennis" gravity bucket conveyor, fitted with automatic tripping levers, into the boot of the elevator mentioned above. The entire process was continuous, and the plant was driven by an A.E.G. motor.

Messrs. Babcock & Wilcox exhibited one of their well-known chain-grate stokers, of which there are now 5,200 in use.

The Carron Co. exhibited an electric cooking range, with which they demonstrated how effectually cooking of all kinds could be carried out with electric heating.

Ozonair, Ltd., had a large exhibit of ozonising apparatus; while the London firm of Carl Zeiss, Ltd., showed their new apparatus for the technical analysis of gas and water by an optical method. This apparatus is most convenient in use, for it can be carried anywhere, and can be arranged either for gas or water tests. By this apparatus percentages of CO_2 and CH_4 in mine gas can be determined within ·01 or ·02 per cent. of accuracy. The weight of the portable "gas interferometer" is 11 lb.

Devices for automatic regulation of the supply of secondary air above the fires and at the bridges of Lancashire boilers were shown by the Smoke Consuming Co., of London; the Compagnie des Brevets Schaller, of Paris; the Treibel Smoke Combustion Co., of London; and H. Kowitske & Co., of Berlin. The last-named was a strongly-made apparatus, and a very large number have been installed in hand-fired boilers in Germany with most satisfactory results, over 300 of these automatic appliances being in use in Hamburg alone. The use of similar automatic apparatus for controlling the secondary air supply of hand-fired boilers has not, so far, become general in this country. It may be hoped that this exhibition of automatic regulating apparatus at the Agricultural Hall will awaken English engineers and owners of steam-raising apparatus to the importance of the subject.

Tintometer, Ltd., showed apparatus for measuring and recording the colour and density of smoke, while Witting Bros. exhibited the Meguin coal screening and washing plant. One permanent result of the miners' strike will be an increase in the cost of fuel, and it would certainly pay many large consumers to buy the very cheapest fuel, and to wash and screen it themselves before use, either by the Meguin process or by some similar English process.

Mr. A. F. Davis, of London, showed a new and improved type of furnace bar, and the Thermal Syndicate, of Wallsend, exhibited a most varied assortment of "Vitreosil" (fused quartz) goods made by aid of electrical heat. Among the chief uses for "Vitreosil" may be mentioned tubes and plates for electric heaters and cookers, pyrometer tubes, for rapid readings and high temperatures, globes for high-pressure gas lighting, basins for sulphuric acid concentration, and all forms of apparatus for the chemical industry. A new use to which the material is now being put is in connection with gas fires, where silica is employed as the heat radiating medium. These tubes and vessels are perfectly acid and heat proof, and can be exposed to most rapid changes of temperature without fracture.

Messrs. Townson & Mercer had a large exhibit of gas-testing apparatus, thermometers and flash-point apparatus. James Hodgkinson, Ltd., of Salford, showed his automatic coking stoker.

Hjalmer Lofquist, of Stockholm, exhibited an electrical apparatus, made in two sizes, for heating bath water. That using 4½ units at 200 volts will raise the temperature of 40 gallons of water 27° F. in 40 minutes.

(To be concluded.)

Blackburn Lighting.—The Corporation has decided to apply to the L.G.B. for sanction to borrow £1,050 for the purpose of extensions to the electricity works.

PROCEEDINGS OF INSTITUTIONS.

The Electric Driving of Rolling-Mills.

By Mr. C. A. Ablett.

On March 27th this paper was discussed by the Institution of Electrical Engineers at Birmingham (for abstract of paper see Electrical Review, February 9th, 1912.)

Mr. W. W. Wood said the friction of fly-wheels was a very important point about which very little was known. The author deduced that a larger constantly rated motor was required with a light than with a heavy fly-wheel, but the difference in power was apparently very slight, and would be surely more than off-set by the extra power required to drive the heavy fly-wheel. The author had assumed that the loss in driving ropes was 10 per cent. of the normal power they were capable of transmitting; but in a paper recently read before the South Wales Institution of Engineers, Mr. Kenyon referred to tests which showed the loss in rope drive to be only 2½-3½ per cent., and he could quite believe it. It seemed to him, therefore, that the loss in a properly-designed drive would just about off-set the lower efficiency which the low-speed motor had, and there would not, therefore, be the great saving to which Mr. Ablett referred. The driving ropes formed a very excellent coupling between motor and mill, and relieved the motor of shock very considerably. Before one could state that either rope or direct drive was the better, the circumstances of each case should be carefully considered.

Mr. N. B. Rosher said that in mills in the Birmingham district, especially sheet mills, a number of rolls were driven from one train, and the peaks which occurred were very irregular. The connection of the motor to the mill was of considerable importance; and to gear the motor to the roll train without inserting some flexible form of coupling was not desirable. The continuous slip regulator was a very desirable adjunct to the electrical equipment of a rolling mill. He thought it would be interesting if he gave some figures with respect to a sheet rolling mill which had two roll trains; the larger was converted from steam to electricity some four years ago, the smaller being still steam driven. The conditions under which both trains operated were very similar, but in the case of the steam-driven train, the costs per B.H.P. per annum were about £11, whereas the costs of the electric drive per B.H.P. per annum were only £4. The steam engine was shortly to be replaced by an electric motor, and it was estimated that the electric drive would pay for itself in a little over two years.

Dr. S. P. Smith, referring to the scheme which the author said had been installed in three mills in this country, asked if the arrangement shown, which might be described as giving constant output at all speeds for a given input, was better for the kind of work in question than the arrangement with the auxiliary machines mechanically independent of the main motor, which was suitable for giving a constant torque at different speeds.

Mr. Judge advocated the use of the rope drive as being a very good flexible coupling, and Mr. More, who had had experience of electrical driving for rolling mills, spoke favourably of it.

Mr. W. E. Milne said that rolling-mill owners paid too little attention to the question of mechanical arrangements when electrifying a mill. A test taken by the Birmingham Corporation Supply Department in a metal works some time ago showed a transmission loss of 70 per cent., while losses of 40 or 50 per cent. were not uncommon. There was a tendency in Birmingham to put too many rolls on one motor; the long heavy train of gearings for such arrangements called for considerable power to drive them. The automatic slip regulator was not required in brass and copper mills, although the introduction of a small amount of permanent slip might be an advantage in certain installations.

Mr. A. Du Pasquier agreed that the slow-speed motor could always justify the additional outlay where rope-driving was the alternative. Mr. Ablett mentioned the case of a 600-H.P. motor driving a sheet mill by means of 20 2-in. ropes. This was certainly an excessive number of ropes to transmit the ordinary overloads of the motor, and presumably the fly-wheel in this case must have been on the motor shaft and discharging through the ropes, which was an undesirable arrangement. It was interesting to note that Mr. Ablett recently recommended a rope drive for a new sheet mill on the north-east coast. There was no doubt that the three-speed rope device, while costing much less than any other system of economic uniform speed control was giving complete satisfaction in practice. The advantage should be with the rotary converter system, especially when more than one mill was to be operated, as would usually be the case. The rotary converter, owing to the small armature reaction and field distortion, was admirably suited to deal with the momentary heavy demands one got with this class of work. Where an average slip was of the nature of 5-7½ per cent., variable speed devices with their considerably increased first cost, greater complication, and greater space occupied were commercially unsound, and their advocacy was to be deprecated.

Mr. A. M. Taylor pointed out that the proportion that the fixed charges bore to the total cost per unit was reduced as the total load on the power station increased, and also as the load factor improved through the increase of the power demands. It was, therefore, to the interest of manufacturers to come on to the Corporation mains. With regard to the overload capacity of electrical machines, they were on the eve of important developments. Much greater overloads than 100 per cent. were quite practicable. At the present time a booster set was being supplied to the Corporation which would be capable of carrying an overload of 500 per cent. for one second.

Mr. R. Orsettion said compound-wound [D.C. motors were very suitable for driving rolling mills. A 300-H.P. machine recently supplied for this purpose by his firm was heavily compounded, and gave 28 per cent. drop from no-load to full load. He did not agree that the Ilgner system involved a total increase in the capital cost of only 10 per cent. In connection with a 10,000-H.P. plant he found that the increase was from 20 to 25 per cent. The 10 per cent. loss in ropes given by the author was probably correct.

Mr. F. J. Moffett (communicated) said that a mechanical slip regulator appeared to be superior to the two methods mentioned. If a suitable slipping-clutch was inserted between the motor and the mill, it was possible in case of emergency to produce a slip of 100 per cent., and then utilise the whole stored-up energy in the fly-wheel. Slipping-clutches suitable for this purpose were made by several firms. The speed of the rolls could fall until they came to rest, but the motor was still able to exert its maximum torque. He was not aware that clutches of this description had been applied to rolling-mill drives. In the case of a three-phase motor, a short-circuited rotor could be used instead of the more expensive and less efficient wound rotor, since the motor would start under practically no load, and there would be no need for a flexible coupling.

In his reply, Mr. Ablett said that in every case of an electrically-driven sheet mill that he had had the opportunity of investigating, sufficient ropes had been installed to transmit normally about double the normal motor power without overloading the ropes. It was not unreasonable to consider the rope losses as consuming 5 per cent. of the normal power which the ropes would transmit, and this loss went on whether the ropes were transmitting their full power or not. So by adopting a rope drive for a sheet mill they had a continuous loss going on, due to the rope drive, which amounted to about 10 per cent. of the normal motor power. This loss was more important in the case of a sheet mill than in any other type of mill because the average power required by the sheet mill was small compared with the maximum power—often not more than one-third of the normal motor power—so that in an unfavourable case the ropes could consume as much as one-third of the total number of units of electricity which were taken by the rolling-mill motor. There were more than 100 electrically-driven rolling mills in this country, and more than 1,000 on the Continent. There were over 50 electrically-driven reversing mill installations in Europe, of which about 30 were at work, the remainder being in course of construction. These figures alone were sufficient to show that electrical driving had justified itself. In almost every one of the electrically-driven reversing rolling mills the motor was direct-coupled to the pinions of the mill, and in one or two cases even to the rolls themselves, the pinions being on the far side of the mill, and no flexible coupling of any form was used. These mills were doing the heaviest work, and were driven by motors capable of giving as a maximum power as much as 20,000 H.P. Some of these reversing mill motors had been at work for four or five years, and not the slightest difficulty had been experienced from shocks. In view of this, it could not be said that in the case of small mills driven by motors up to 1,000 H.P. or over, the effects of shock were in any way to be feared. In the case of a motor driving a rolling mill where a fly-wheel was employed, carried in separate bearings, a flexible coupling interposed between the motor and the fly-wheel would protect the motor bearings from any ill effects due to possible slight lack of alignment between the motor shaft and the fly-wheel shaft. The chief objection to the pole-changing three-phase motor and the three-phase cascade system as applied to merchant mills, where a variable speed was required, was that they only gave a few fixed speeds which in general did not prove sufficient to meet the requirements of the mill, so that resistance would have to be inserted in the rotor circuits in order to obtain intermediate speeds, which involved waste of power. As a merchant mill was rolling heavy sections at the low speeds, which required a greater turning moment than the smaller sections which were rolled at a high speed, in general the motor driving a merchant mill had to be capable of giving the same power at all speeds. If a pole-changing motor, therefore, was employed, it would have to be a big machine, of which the capital cost would naturally be high, in order to give the required power at the low speed. Both the pole-changing motor and the three-phase cascade system suffered from the disadvantage that the power factors at low speeds were not good. Mr. du Pasquier offered some criticism of the variable-speed scheme illustrated, and seemed to prefer the use of a direct-current motor supplied with current through a rotary converter and a transformer for driving a merchant mill where three-phase current only was available. The author was not in agreement with this, because, in the case of the scheme shown, the main three-phase motor was the only machine really necessary to drive the mill, and the rotary converter and the direct-current motor could be regarded as refinements introduced for the sake of economy. If anything should go wrong with either of these two machines, then the mill could still be run without interruption by the main three-phase motor. The arrangement shown, which must be regarded as a single-link chain, had a much greater reliability than the arrangement of transformer, rotary converter and direct-current motor, which might be regarded as a three-link chain. With reference to Mr. Taylor's remarks about the overload capacity of electrical plant and the advisability of allowing mill motors to carry such overloads, it might be mentioned that direct-current motors were being regularly built for 300 per cent. overload and more. Dr. Smith referred to the frequency changer as a means of obtaining variable speed from a three-phase motor without loss of power. At the Hagen Cast Steel Works in Westphalia, as well as in several other places, such an arrangement was adopted for driving the merchant mills. The frequency converter generally resembled a rotary converter, but the field poles had no winding. If a rotary converter was run at a synchronous speed and supplied with three-phase current, it would give direct-current at the com-

mutator. If however, the rotary converter was at a standstill, the three-phase current would pass through the machine with unchanged frequency. If a rotary converter were run at speeds intermediate between synchronous speed and standstill, then the frequency at the commutator was proportional to the amount by which the speed was below synchronous speed. It was, therefore, possible to couple such a frequency converter to a three-phase motor, to connect the commutator of the frequency converter to the three-phase motor, and to connect the slip rings of the frequency converter to the supply mains. If then the main three-phase motor was to be run below speed, the frequency converter took power out of its rotor circuit, converted this power from low frequency back to the frequency of the supply, and returned it to the supply mains, so that the power was not wasted. When such a frequency converter was used, the main three-phase motor could run above synchronous speed, but in this case energy was taken from the supply system and given to the rotor circuit, and it was usual in a frequency converter drive to choose a synchronous speed, so that it came about the middle of the speed range over which variation was desired. In the case of high-speed Ilgner fly-wheels, the windage formed by far the greatest proportion of the loss, and it was found in practice that most of this windage was produced by the rim of the wheel, so that if a light metal cover was provided over the rim of the wheel the windage loss could be reduced to reasonable proportions. It might reasonably be expected that the commutator three-phase motor for driving rolling mills would find considerable adoption in the future.

Physical Society.

At the meeting held on March 22nd, a paper on "A 2,000-Frequency Alternator," was read by Mr. W. Duddell, who described and exhibited a small machine which he had designed and had constructed for testing purposes, mainly in connection with telephonic measurements. The alternator was of the salient-pole revolving-field type, running at 8,000 R.P.M. The stator was smooth and wound like a gramme ring, the object being to obtain as nearly as possible a sine wave. The author gave curves showing the open-circuit characteristic, the short-circuit current and the regulation of the alternator at four different frequencies. The output of the alternator amounted to as much as ½ KW. at the higher frequencies. Oscillograph curves showed that a slight third harmonic was present.

Mr. B. S. Cohen stated that Mr. Duddell had supplied one of his alternators to Telephone House, and it had given thorough proof of its reliability and usefulness. The third harmonic that was present was no practical detriment. If the capacity of a microfarad mica condenser was found from the current taken by it and the voltage applied, the error was less than 0·5 per cent. at a frequency of 1,000. The instrument lent itself to a variety of interesting uses. If a telephone were put across the machine when run at the resonating frequency, the amplitude of vibration was such that matches could be blown out at a distance of 3 or 4 metres.

Mr. S. A. Pollock described a somewhat similar machine that had been constructed five years ago, and was still running at the G.P.O. The rotor contained 60 poles, which were wound zigzag with eight turns of wire. It had been run up to frequencies of 8,000, and was perfectly balanced at the highest speed. The machine was largely used for measuring the apparent resistance of loading coils. The wave-form was purified by means of sifting circuits. To keep the frequency constant a vibrating reed was placed in series with a split commutator fixed on the shaft of the rotor and connected in series with the armature. If the rotor ran out of phase with the reed, either an accelerating or retarding current was sent through the armature. A counter and a chronograph always showed that the number of revolutions per minute was exactly the same as the vibrations of the reed.

Dr. W. E. Sumpner commented on the small drop in voltage at the high frequencies. From a scientific point of view, the chief points in the machine were the large air gaps and the unslotted armature. It was to these that the good regulation was due.

The Author, in reply, stated that in the later machines the armature was wound in three sections, which could all be placed in parallel or in series, to avoid having to use a transformer in order to obtain the required voltage, which might distort the wave-form. The zigzag form of winding was an excellent one for the highest frequencies. Messrs. Muirhead & Co. built the machine.

A paper on "A Method of Comparing Capacities at Various Frequencies" was read by Mr. A. Campbell.

To compare the capacities of two condensers under conditions similar to those in Maxwell's commutator method, they are charged and short-circuited periodically in two adjacent arms of a bridge by a double rotating commutator, the corresponding contacts being made simultaneously. If the other arms of the bridge are resistances R and S, and a battery and direct-current galvanometer (of long period) are used, then a balance is obtained when $K_2/K_1 = R/S$. The method is highly sensitive. Methods (like the above) in which the applied voltage has a square-topped wave-form give results in agreement with those using sine wave-form when the period of charge (and equal discharge) with the square-topped wave is $2/\pi$ times the half-period of the sine wave.

The Faraday Society.

Comparative Tests of Dry Cells.

Amidst a lengthy programme for the Faraday Society meeting on March 26th, a paper of special electrical interest was that by Mr. S. W. Melsom, of the National Physical Laboratory, entitled "Dry Batteries: the Relation Between the Incidence of the Discharge and the Relative Capacity of Cells of Different Manufacture." Mr. Alexander Siemens, vice-president, was in the chair.

Probably few people realise the extent to which dry cells are used, chiefly, of course, in telephone work. Last year, so it was stated, the National Telephone Co. alone used 300,000, while in the United States some 40,000,000 are said to be in use. Such being the case, it is a matter for some surprise that, apart from the prolonged test of actual use, there is at present no standard test by which to gauge the relative value of a cell which is generally accepted by manufacturers and users alike. The present position is chaotic to an absurdity, as Mr. Maurice Solomon forcibly pointed out in a communication to the discussion on Mr. Melsom's paper. Every consumer of primary batteries—dry or wet—who buys in large enough quantities issues a specification of his own, the essential feature of which is usually its originality. Frequently not only the results required, but even the method of manufacture, is specified, and it is therefore eminently desirable that some standard simple test should be devised, which could be adopted by all users of primary cells. It was some such test that Mr. Melsom set out to devise. Unfortunately, however, valuable and important as his results are, he has not considered himself justified in pointing to any one of the numerous methods of testing investigated, as *the* test to be safely employed in gauging the value of a cell, no matter for what purpose it is to be used.

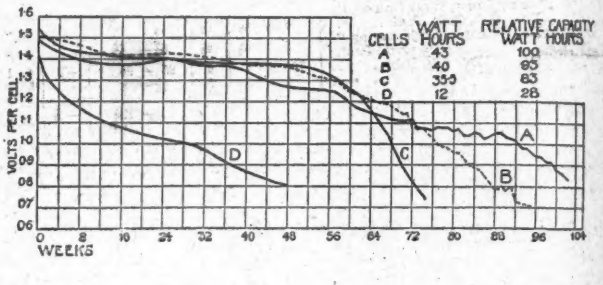


TABLE I.—Relative Capacity of Cells at Various Rates of Discharge.

No.		Cells. A.	B.	C.	D.
1	5 minutes an hour on 50 ohms ...	100	93	83	28
2	5 minutes an hour on 1 ohm initial	100	59	43	7
	After 6 months' storage	100	58	50	—
	After 12 months' storage	100	53	42	—
3	6 hours per day on 5 ohms	100	50	50	35
4	Continuous at 20 milliamperes—				
	Initial ampere-hours	100	43	36	30
	Initial watt-hours	100	45	40	29
	After 8 months' storage, watt-hours	100	50	45	5
5	Continuous on 10 ohms—				
	Initial to 0·7 volt	100	75	53	60
	Initial to 0·5 volt	100	76	55	60
	After 6 months' storage—				
	To 0·7 volt	100	59	44	28
	After 12 months' storage	100	67	50	2
6	Continuous on 100 ohms	100	68	51	35
7	Continuous on 500 ohms—				
	To 1·3 volt	100	102	87	10
	To end, *i.e.*, 118 weeks	100	94	—	—

For the purposes of the tests four well-known makes of cell were used, four of each being selected at random from a batch of 60 supplied by the manufacturers. For obvious reasons it is impossible to divulge the names of the cells, and they are designated in the tests as A, B, C, and D. It is noteworthy that, whereas in nearly every test Cells A, B, and C showed good and tolerably uniform results, Cells D (which were stated to have quite a good reputation) fell below what ought to be the performance of an ordinary dry battery. This fact alone indicates the importance of making proper tests.

The results of the tests are summarised in accompanying tables. Table I shows the relative capacities of the four makes under the various rates of discharge stated, the output of Cell A being taken as 100 for comparison, and Table II gives the actual capacities in watt-hours in the case of each of the seven tests.

The original paper contains a very interesting series of P.D. curves for every set of tests, but space will only permit us to give here those for Test 1, namely, a discharge of five minutes per hour through a resistance of 50 ohms, as this reproduces as closely as possible the working conditions of a cell on a telephone circuit. The voltage plotted is the P.D. in closed circuit. The discharge was considered complete at a voltage of 0·9, because the current at this point, 0·018 ampere, is the smallest that will work a telephone microphone.

Test 2 is similar to 1, but employs a far higher current. Test 3 is

that specified by the National Telephone Co., while 4 is that formally specified by the Post Office. Test 5 is a favourite with manufacturers, and 6 is on similar lines, but uses a greater resistance. Test 7 is a War Office test.

TABLE II.—Relation between Incidence of Discharge and Capacity.

Test No.	Cells. A.	B.	C.	D.	Approximate time for completion of Test 1, case of cell A.
1	43	40	36	12	100 weeks.
2	44	26	10	3	65 ,,
3	126	63	63	46	20 ,,
4	105	47	42	31	27 ,,
5	64	49	35	38	6 ,,
6	107	73	55	38	50 ,,
7	70	66	—	—	Several years.

It will be seen from the tables that very widely varying results were obtained for the capacities in the different tests employed, so that it is not possible to specify any single method of testing as a standard which can be safely employed under all circumstances. Only one of the tests, No. 5, takes a reasonably short time, and this, in the case of cell A, gives a capacity some 40 per cent. higher than Test 1, which is supposed to approximate most closely to conditions of practice. It is, nevertheless, noteworthy that the order of merit of the cells is in every case the same.

Under the circumstances, it would appear that the only safe course for users to adopt is that recommended by the chairman, namely, make the test on sample cells under actual conditions of use, and then insist on the manufacturer employing such care in the process of manufacture as will ensure all his cells of a particular class giving perfectly uniform results.

It is of interest to note that cells A, B and C showed little or no deterioration after 12 months' storage. This fact should suggest uses for dry cells, for instance, as a stand-by on motor-cars for ignition, or for special lighting purposes (where cost is of not much consideration), which are at present overlooked.

Domestic Electricity.

(*Informal discussion at the* Institution of Electrical Engineers, *London, March 22nd*, 1912.)

The President, in opening the meeting, referred to the necessity of extending the use of electricity in the home. The discussion was to some extent a result of his suggestion to organise a campaign for cheaper electricity; it was, however, thought by the Council that price was not the only deterrent to its general adoption, and that a comprehensive discussion of the whole subject would be beneficial. The advanced development of lighting by gas and oil suggested that further improvement would be difficult, while electricity was a comparatively recent introduction as a lighting and heating agent, and it was open to great and rapid improvement, and offered every scope for progress.

Mr. C. A. Baker (L.C.C.) said that domestic electrical apparatus showed great development in recent times; its advantages were often indirect, and thus not so readily appreciated by prospective users. It required proper control in order to get economy in its use, and he suggested that it would be better to provide switches on cooking apparatus in which the handles indicated at a glance whether on or off. The great variety of voltages in the London area hampered both makers and dealers in such apparatus.

Mr. H. H. Couzens (West Ham) suggested that progress was retarded by half-hearted publicity effort and the high cost of apparatus. The amount spent on publicity work by the supply authorities was infinitesimal, and this was often due to the engineer who preferred to ignore the commercial side of the business. A definite expenditure must be allocated to publicity and selling. The publicity committee's literature was not suitable for all places, and he thought that the Institution might with advantage take over its work; the publicity committee was to some extent philantrophic, and such an arrangement never worked so well as an ordinary commercial one. He suggested co-operative buying of apparatus and coal as a means of reducing the present cost of those things; this might be carried out through a Committee of the Institution nominated by those interested financially. The gas companies were far better off in the matter of powers and reserves than municipal electricity departments, which were even short of trading capital, a matter which the new Parliamentary Bill might set right. Publicity literature was of little use unless followed up by the canvasser, and a sales department was essential to the success of an electricity undertaking.

Mr. W. R. Cooper analysed his own impressions as a consumer, coming to the conclusion that the coal fire, though dirty, was cosy and not costly with a modern range. From a rough test he found that his range burnt 1½ lb. coal an hour over 13 hours and cost about 2d. per hour, and to substitute electricity at 2d. per unit for radiator purposes was obviously out of the question.* The gas cooker was also cheap to buy or hire and to use, while similar facilities for obtaining electrical cooking apparatus were non-existent. The hot water difficulty might be got over by connecting an electrical heater direct to the mains—giving 100 per cent. load factor—but the price must be less than ½d. per unit.

* Mr. Cooper takes an extreme case.—Eds. E.R.

Mr. S. Evershed advised the supply engineer to get rid of his ideas on the subject of peak loads. Other people in the ordinary way of business had peak loads, but did not find it necessary to use maximum-demand systems of charging. He considered that a flat rate of 1½d.-2d. per unit all round would result in his greatly extending his use of electricity for domestic purposes, while cooking was practicable at 1d. per unit. Touching on the hot water question, in the ordinary way it cost him £16-£18 a year for house coal, the hot water being available from the kitchen range; by comparison he found that a 100 per cent. L.F. electrical water heater, taking energy at 1d. per unit, would cost almost as much for hot water alone, viz., £15. [Contract rates of about 5d. per unit have been quoted for water-heating apparatus of this kind.—Eds. E.R.] Present-day methods of obtaining new business were very poor; practical demonstrations were the only way to impress some people. As an instance of the way some supply authorities look after their consumers, he mentioned that he had only had two postcards from the electricity undertaking in seven years.

Mr. F. W. Willcox referred to the publicity work carried out by American electricity suppliers. The American stations had load factors on the average of 40 or 50 per cent., and were selling about 10 times as much current per head as in this country at about 60 per cent. of the price. The contributions made towards advertising and similar work by American central stations varied from £300 per annum for a small one to £6,000 per annum for a large one, and totalled over £400,000 a year, the great bulk being spent on newspaper advertising.

Mr. W. A. Vignoles (Grimsby) said the cost of putting in electric wiring and apparatus, and the objection to pulling the walls about, deterred people from adopting electricity more than the price of energy; the householder, however, could be caught—by means of suitable advertising—when he was redecorating his house. In Grimsby he had used all forms of advertising, and the number of new consumers per annum has risen from 70 to 200. To get over the wiring difficulty some rental system must be adopted, but few Corporations had power to carry out such a scheme; Corporations should be able to finance such work, but whether they carried it out themselves was not really material. The builder would not wire small houses, which work should be done in bulk, several houses being supplied through one service. Ordinary heating and cooking was practicable at 1d. per unit, with a differential rate giving reduced prices for all day use, but the cooking apparatus was too costly, and he found that contractors charged too much for hiring it; the Corporations must have powers to do this class of hiring.

Mr. A. Bruce Anderson (Ferranti, Ltd.) considered that the cost of energy was at the root of the trouble; if apparatus were given away, it would not be used unless the price of energy was substantially reduced.

Mr. F. Husband (Glasgow) mentioned some figures of cost per winter quarter, with a three-room plus kitchen house, which were as follows: (*a*) Gas lighting 19s. 6d.; (*b*) gas heating 12s. 6d. and electric lighting 15s.; (*c*) electric lighting and heating 17s. 6d.; the cost of gas was 2s. 1d. per 1,000 cb. ft. and of electricity 3d. per unit. He came to the conclusion that the cost of energy was not so important as the cost of apparatus. The supply authorities must take up the provision of apparatus; in Glasgow, it was known that the contractors were working only for themselves.

Mr. L. Buckell (Newcastle-on-Tyne) agreed that the cost of energy had very little to do with the extension of the use of electricity. The difficulties raised by consumers would disappear if the central station carried out its work properly, but he was afraid that assisted wiring on a large scale would do more harm than good. He urged the necessity for co-operation in advertising and business getting; a big scheme was necessary with ample funds to carry it out.

Mr. E. L. Ingram (Bournemouth) also spoke on the difficulty of supplying the smaller consumer judging by the estimated cost of energy at present prices.

LEGAL.

Accumulator Industries, Ltd., *v.* Vandervell & Co.

In the Chancery Division before Mr. Justice Eve, on Tuesday, April 2nd, Mr. Jessel, K.C., with whom was Mr. Winney, moved on behalf of the plaintiffs in this action, for an injunction to restrain the defendants from using and publishing in connection with their goods, testimonials and letters sent to their agent, who is now the representative of the defendant firm, while he was in their (the plaintiffs') employ.

Mr. P. O. Lawrence, K.C., and Mr. Ward Coleridge appeared for the defendants.

Mr. Jessel said that the Accumulator Industries, Ltd., were the licensees for this country of certain patents relating to the lighting of motor vehicles by electricity. Originally the patent was applied only to trains, but subsequently it came into use for motor vehicles generally. The licensees entered into an agreement with the defendants for the sale of their machinery in Great Britain and Ireland for general use except on railways and metropolitan omnibuses. The plaintiff company agreed with the defendants that they should at all times use their best endeavours to promote the introduction and sale of their dynamos, and the defendants undertook that during the time they were so engaged they should not become directly or indirectly interested in any other dynamos. The licensees agreed to provide all dynamos at cost price to the defendants, who were to give them half the profits of sale after

deducting 10 per cent. The agreement was to be binding for one year, with the option to the defendants of renewal. The defendants experimented with the machine, and at the close of the year's agreement they, as Vandervell & Co., put a new machine upon the market, and they sold other things connected with electric lighting outfits. In association with their business they issued a pamphlet entitled "Electricity *v.* Acetylene Oil," and in connection with it they used the name C.A.V.

Mr. Lawrence: The C.A.V. system was used long before.

Mr. Jessel: In September, 1910, the defendants brought out another patent, the agreement having terminated, after a year, in April, 1910. In November, 1911, they issued another document, which they called "Something striking," and of that document the plaintiffs complained, as it contained testimonials sent to defendants' representative while he was their agent, and had reference to their dynamos which had been fitted to the cars of the writers. The defendants were then selling as the C.A.V. system their own Vandervell dynamos, and what the plaintiffs complained of was that testimonials referring to dynamos supplied by them were used as having reference to the defendants. They omitted the dates for the purpose, suggested counsel, of destroying identity. That, he said, was a breach of the contract of agency, and his second point was that it was a clear case of passing-off. The testimonials were used for the purpose of showing that the articles supplied had given satisfaction, and to induce other people to buy.

Mr. Justice Eve: What does your writ ask for?

Mr. Jessel said it asked for an injunction to restrain the defendants from pushing the sale of their dynamos in substitution for those of the plaintiffs.

Mr. Justice Eve said he could not see what was the cause of action. Did the plaintiffs say that the letters belonged to them?

Mr. Jessel said that they did not; but they had such property in them as would entitle them to say that they should not be used adversely to them. The use the defendants were making of them, amounted to a passing-off. As they were not entitled during the year to become commercially interested in any other invention, they were not entitled afterwards to use anything obtained during that year for their own purposes as against the plaintiffs. They had no right to use testimonials given for one set of goods for the purposes of another set.

Mr. Justice Eve said he could not see what right of property there was in the testimonials. It did not arise out of the contract.

Mr. Jessel said it was the right of every trader to see that the goods of other people were not substituted for his.

Mr. Justice Eve asked whether the testimonials did not apply to the substitution of self-sustained electric lights for the old oil lamps.

Mr. Jessel said the plaintiffs thought that some of the testimonials were asked for in relation to their dynamos. As the plaintiffs' agents, there was an obligation upon the defendants to push the plaintiffs' machine, and no doubt they would be entitled to use the testimonials, while they retained the agency, but they were not entitled to use them for purposes which were foreign to the agency.

Mr P. O. Lawrence, for the defendants, argued that the motion was ill-founded. There was no principal and agency in the case at all. The defendants were the sole consignees of the electric motor, and directly they paid for them they became their property, but they agreed to give the plaintiffs half the profits upon re-sale. If he was right in that, the whole cause of action went. The letters and testimonials were the property of the defendants, who had a right to use them as they thought fit. There was no passing-off and no agency.

Mr. Justice Eve, in giving judgment, said that the claim for relief was based upon the relationship between the plaintiff and the defendants, and it was quite obvious that the plaintiffs were proceeding upon the footing that the defendants were, by the agreement, constituted their agents, and that the testimonials were received by them in that capacity. That, however, did not appear to be the case. The whole matter depended upon the relationship between the parties under the agreement. The defendants had apparently for some years been endeavouring to perfect a system of lighting motor-cars by electricity, and the plaintiffs, being the owners of a portable dynamo, came to the conclusion that it might be utilised for the purpose, and they approached the defendants with that view. It became necessary to arrange special terms in order to make business, and an agreement was entered into. There was incorporated in the agreement a covenant that the defendants would not do anything during the year which would interfere with the success of the plaintiffs' invention. He did not think the description of the defendants, as selling agents, was correct. They were simply consignees of the plaintiffs' goods, but that was a point for further consideration at the trial of the action. It was sufficient for him at present to say that he did not see his way to giving the plaintiff the relief for which he asked, on the footing that there was a fiduciary relationship between the parties. All he could do now was to refuse the motion.

Mr. Jessel: Will your Lordship make the costs of the motion costs in the action?

Mr. Justice Eve: No.

Shrimpton *v.* Northern Light, Power and Coal Co., Ltd.

This case came before the Court of Appeal, composed of the Master of the Rolls and Lord Justice Buckley, on Monday and Tuesday last week, upon the appeal of the plaintiff from an order of Mr. Justice Eve in the Chancery Division refusing to grant an interlocutory injunction restraining the defendant company, its directors, and agents until the trial of the action, or further order from issuing any more bonds in pursuance of a resolution passed at a meeting of debenture-holders held on August 18th last. The resolution sanctioned the issue of $1,000,000 prior lien bonds.

It appeared that the plaintiff was the holder of some of the original first mortgage 5 per cent. gold bonds of the defendant company, and he alleged that the chairman at the meeting in question had made misstatements as to the validity of a contract which the defendant company had entered into with the Klondyke White Channel Gold and Gravel Mining Co., by which the latter company undertook to take from the defendant company a large quantity of electric power. Plaintiff alleged that he subsequently discovered that the defendant company had no claim on the contract, and that the representations made were not substantially true, and he claimed that the defendant company could not put the resolution into force.

At the conclusion of the arguments of Counsel, their Lordships dismissed the appeal with costs, holding that it was not a case of an interlocutory injunction.

Electric Lighting Company Fined.

On April 2nd, at the Wonford Petty Sessions, the Topsham Electricity Supply Co. were fined 2s. 6d. and costs for employing a lad, Frank Stanley Boucher, on their premises on Sunday, March 10th. On behalf of the company, it was explained that the lad was a pupil of the engineer. He had a special desire to acquire knowledge, and, in compliance with a request made by him, the engineer allowed him to be at the works every third Sunday evening between six and eight.

Southport Engineering Co., Ltd., *v.* Taylor.

At the Southport County Court, on April 2nd, the plaintiffs sued A. Taylor, engineer, of Virginia Street, for £28 18s. 6d., for work done and material supplied.

Counsel for plaintiffs said that defendant intended to patent a machine for converting refuse into electrical energy by means of an "electric whirlpool," which was going to revolutionise motive power. No proper drawings were submitted, and a great deal of the work done was purely experimental and had to be discarded.

Mr. Schofield, of the plaintiff firm, giving evidence in support of the case, said he could not understand from the inventor at first what the machine was intended for, but its vital part was a hollow egg-shaped piece of metal, on which defendant had mapped out all the component parts of the earth. The inner portions of the machine would be made to radiate in opposite directions, and so create the electrical whirlpool. His idea was that he could put all sorts of refuse into the machine, magnetise it with a given voltage, and convert it into energy. He could, he said, take the machine to a colliery, put in coal-dust, and convert it into energy with 90 per cent. of efficiency.

For the defence, it was submitted that the charges were excessive.

The Judge found for plaintiff for the full amount, with costs. His Honour pointed out that this was an experimental article, and when it was begun the inventor had no accurate or clear idea of what he required, and allowance must be made for the number of times it was pulled to pieces.

Foster *v.* E.C.C.

At Walsall County Court, on the 3rd inst., an action was brought by Messrs. Foster Bros., of Wednesbury, to recover £29 1s. 1d., balance due on a contract with the Electrical Construction Co., Ltd., of Bushbury, Wolverhampton. There was also a counter-claim for the same amount on the ground that the installations of steam exhaust and water pipes were imperfect, and not reasonably fitted for the purpose for which they were required.

Mr. Wright, for the defence, stated that the claim was admitted, and the action turned on the counter-claim.

The Judge awarded £29 1s., with costs, on the claim, and gave judgment for the defendants on the counter-claim for £14 15s., with costs. Leave, however, was given to appeal, and a stay of execution was granted.

Tucuman Hydro-Electric Undertaking.—The Compania Hidro-Electrica de Tucuman have just placed in London a large amount of debentures and ordinary shares for the extension of their hydro-electric works and 1,200-volt railway which they are now constructing in the province of Tucuman, Argentine Republic. The company will be in the market for large quantities of materials of all classes, including high and low tension materials and 1,200-volt railway equipments. The London offices of the company are at Donington House, Norfolk Street, Strand, W.C.

Works Closed.—Messrs. Mawdsleys Ltd., of Zone Works, Dureley, closed their works from the evening of Thursday, 4th inst., until 9 a.m. on Monday next, 15th inst, in order to give their foundry an opportunity of replenishing its stock of castings. We understand that, although at the beginning of the strike they endeavoured to provide for all demands, the number of orders since received has been so large as to seriously diminish the stock.

BUSINESS NOTES.

Book Notices.—"*Journal* of the Western Society of Engineers." Vol. XVII, Nos. I and II. January and February, 1912. Chicago: The Society. Price 50 cents.

"Investigations of Explosives used in Coal Mines." By C. Hall, W. O. Snelling and S. P. Howell. "Investigations of Fuse and Miners' Squibs." By C. Hall and S. P. Howell. "The Rate of Burning of Fuse." By W. O. Snelling and W. C. Cope. 1912. Washington: Government Printing Office.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 2. February, 1912. New York: The Society. Price 75 cents.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 3. March, 1912. New York: The Society.

"The *Physical Review*." Vol. XXXIV, No. 2. February, 1912. Lancaster, Pa.: The *Review* Office. Price 65 cents.

The April issue of the *Marconigraph*, published monthly by Marconi's Wireless Telegraph Co., Ltd., has been enlarged to 48 pages, and contains many articles of general and technical interest. An illustrated account is given of the details of the Empire scheme of wireless telegraphy, and of the contract for the establishment of stations in Portugal.

Bankruptcy Proceedings.—David Roberts, electrical and motor engineer, 30, Macklin Street, Derby, late 3 and 5, Whiston Street, Derby.—An application was made last week to the Deputy-Judge Gurner, sitting at the Court House, 20, St. Peter's Churchyard, Derby, for the discharge from bankruptcy of the above-named debtor. The Official Receiver reported that the receiving order was made in June, 1902, on the debtor's own petition. The liabilities expected to rank for dividend totalled £137, but proofs actually admitted amounted to £120. The assets so far as they were not assigned to creditors figured at £46, and a dividend of 6s. 8d. in the £ had been paid. The debtor started business in 1900 without capital, and he had failed to keep proper books of account. He had also continued to trade after knowing himself to be on the wrong side, and had failed to satisfactorily account for a sum of £70. His Honour said that although the explanation of the loss of this amount was unsatisfactory, he thought the dividend was fairly substantial. Ultimately the discharge was granted, subject to a suspension of two years.

J. Tizzard, electrical engineer, Abbey Road, Torquay.—Receiving order made March 29th at Exeter Court, on a creditor's petition. First meeting April 15th, public examination April 25th—both at Exeter.

Dissolutions and Liquidations.—W. G. Haywood and Co., electrical fittings dealers and manufacturers, 56, High Street, Bloomsbury, W.C.—Messrs. S. G. Brounger & W. G. Haywood have dissolved partnership. Mr. Haywood attends to debts, &c.

Eckstein, Heap & Co., electrical engineers, 5, Chapel Walks, Manchester, and Waverley Mills, Salford.—Messrs. August Eckstein and A. C. Heap have dissolved partnership. Mr. Eckstein will attend to debts and continue the business under the same style. Mr. Eckstein, who has taken over the business, is retaining the entire staff, and will conduct it on exactly the same lines as heretofore. In order to cope with the increased demand for the firm's manufactures, the factory will shortly be removed to larger premises.

Metalite, Ltd.—A petition for the winding up of this company presented on April 1st by A. B. Reckitt, merchant of St. Leonards-on-Sea; W. G. Dell, London; T. C. E. Goff, London; and E. J. Previté, merchant, of London, contributories of the company, is to be heard on April 17th.

Bradford Electrical Co., Ltd.—This company is winding up voluntarily with Mr. J. H. Haley, 62, Market Street, Bradford, as liquidator. A meeting of creditors is called for April 19th.

Stockall-Brook Time Recorders, Ltd.—This company is winding up voluntarily. A meeting of creditors is called for April 15th, at Huddersfield. Liquidator, Mr. O. Avison, 19A, Westgate, Huddersfield.

Telephone Development Co., Ltd.—This company is winding up voluntarily with Mr. M. W. Jenkinson, 22, Broad Street Avenue, E.C., as liquidator.

Caribbean Anglo-Colombian Cable Co., Ltd.—A meeting of creditors is called for April 18th, at 65, Bishopsgate, London, E.C. Mr. A. R. Bennett, of that address, is the liquidator.

Henley's Flexibles.—Messrs. W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, E.C., announce that they are now manufacturing their "C.M.A." and "Association" flexibles in smaller sizes than previously, namely, in 13/36 s.w.g. = No. 22 s.w.g. A stock in this size in silk, cotton, and workshop finishes is kept by the firm, and a slip is being circulated stating the prices.

Coal Strike Effects.—Notification was posted at Messrs Dick, Kerr & Co.'s electrical works that the greater portion of the works will remain closed until Monday, April 15th, or, if the coal strike was not over by that date, until further notice. Between 900 and 1,000 men are employed at the works, and about three-quarter of this number are affected by the extended stoppage which has been rendered necessary by the shortage of fuel.

Catalogues and Lists.—Messrs. C. Jennings & Co., Pennywell Road, Bristol.—Two hundred and sixty-four-page pocket-size catalogue, containing particulars of a very full and complete collection of manufactured woodwork of British manufacture. It is a production of a somewhat different kind from those usually noticed here, but it is both interesting and serviceable. The goods that are illustrated and briefly described, and of which prices are given, include such varied lines as the following:—Portable buildings, motor sheds and workshops, greenhouses and summer houses, woodwork for use in house and shop building, fretwork arches, pannelling and staircases, woodblock flooring, wheelbarrows, cabinets and bookcases, door frames, wire fencing and netting, and last, but by no means least, there are electric wood-casings and cappings, creosoted troughing for underground cables, and hardwood cable bridges.

From the Emanda Engineering Co., of Emanda Works, Laurie Grove, New Cross, London, S.E., we have received a glass paper-weight for desk use, together with an intimation that on application similar weights will be sent to any electrical firm interested in accumulator switchboards, distribution boards, fuseboards and electrical cabinet work.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot.—New pamphlet (No. P 119) of eight pages containing descriptive notes, half-tone illustrations, and price information, relating to Prescot welders for welding tires of a number of different sizes.

The Rees Roturbo Manufacturing Co., Ltd., Wolverhampton.—24-page pamphlet (No. R.115) containing a full description with line diagrams, half-tones and curves, of their rotary jet condensers and high vacuum air pumps.

The Union Electric Co., Ltd., of Park Street, Southwark, S.E., as an Easter souvenir, have sent out a neat vest pocket celluloid envelope of sticking plaster. The envelope carries a calendar for 12 months from April 1st.

The "Attracta" Electrical Co., 75, Fetter Lane, London, E.C.—Priced leaflet relating to the "Ajax" electric cycle lamp outfit.

Mazda Lamps.—The British Thomson-Houston Co., Ltd., announce that the 5 per cent. extra charge for Mazda lamps for series burning is now withdrawn.

Fire.—Messrs. Mann, Egerton & Co., Ltd., electrical engineers, whose establishment was destroyed in the great fire at Ipswich on Saturday, have opened temporary offices at Imperial Chambers, Princes Street.

The A.E.G. in Mexico.—The A.E.G. Mexikanische Elektrizitäts Gesellschaft has been formed in Berlin with a capital of £100,000 for the purpose of representing the A.E.G. in Mexico and Central America.

For Sale.—The Greenock Corporation electricity department has for disposal one 100-kw. Belliss-Silvertown balancer set and two 150-kw. Belliss-Silvertown sets. See our advertisement pages to-day.

Trade Announcements.—Mr. T. J. Doyle has removed from Houghton-le-Spring to 48, Houghton Road, Hetton-le-Hole, co. Durham.

Messrs. Lord & Shand, Ltd., of Plymouth, have opened a branch at 56, Chapel Street, Penzance, Cornwall. They invite firms to forward catalogues.

Messrs. Worsley & Page, Ltd. (late F. Worsley & Co., of Peterborough) are in occupation of their new premises, Beaver Works, Cornbrook Road, Manchester, where they have every facility for carrying out electrical machinery repair, and other work.

In order to deal more promptly with the commercial side of the business, the head office of The British Electric Plant Co., Ltd., Alloa, is to be removed from Alloa to 144, St. Vincent Street, Glasgow, and all communications after April 15th should be sent to this address. Mr. R. H. Willis, the general manager of the company, has been elected a director, and will be located in Glasgow. The company have also opened an office at 11, Queen Victoria Street, London, E.C., where Mr. A. T. Young (from the head office) has been appointed local manager.

LIGHTING and POWER NOTES.

Abingdon.—The T.C. has adopted a report of the Electric Lighting Committee accepting the offer of Messrs. Edwards and Armstrong, of Bristol, to take over the prov. order when obtained by the Council. Among other clauses in the agreement, it is provided that the firm shall reimburse the Council the costs incidental to the prov. order, not exceeding £275; that a limited liability company shall be formed; the Council to permit overhead wires fixed to neat steel poles; the charges to private consumers not to exceed—For 0 to 50 units, 6½d. net cash per unit (7d., less ½d. discount); from 50 to 250 units, 6d. net cash (6½d., less ½d. discount); over and above 250 units, 5½d. cash (6d., less ½d. discount). Minimum charge of 10s. for each quarter between September 29th and March 25th, and 5s. per quarter for the other two quarters of the year. These charges not to be increased without the consent of the Council; the standard rate of dividend shall not exceed 8 per cent., but in order to encourage the charging of a lower price for

light, it is provided that for every reduction of a ½d. in the price charged per unit, an increase of ½ per cent. may be made in the dividend payable by the company; that power is reserved for the Council to purchase the company's undertaking.

Accrington.—The Haslingden Corporation having asked upon what terms this Corporation would be prepared to carry out the work of laying services and mains for the supply of electric current within that borough, the electrical engineer has been instructed to go into the matter, and authorised to undertake the work provided satisfactory terms can be arranged.

Argentina.—The electric light station at Colon (Buenos Ayres), is finished, and the first trial of the machinery took place on March 8th with satisfactory results.

The electric light station at General Paz, Province of Buenos Ayres, will be inaugurated in May, the works being well advanced.

The Government of the Province of Buenos Ayres has forwarded to the Legislature an *ad referendum* contract with the R. P. Electricity Co., in place of the existing contract.

The Compania Alemana Transatlantica de Electricidad has resolved to increase its capital by a further 20,000,000 marks, which will be principally used for the enlargement of the Dock Sud power house.—*Review of the River Plate.*

Australia.—Newcastle, N.S.W.—Following the appointment of Mr. J. E. Donoghue as consulting engineer, and Mr. Guy Allbutt as city electrical engineer, the City Council has embarked on a large scheme of reconstruction for its electrical undertaking. To this end a sum of £10,000 has been borrowed, and the work is to embrace a general reconstruction of all overhead mains, erection and equipment of four new sub-stations, a system of high-tension series lighting for the city generally on the constant-current principle for both arc and incandescent lamps. It also provides for the erection of a condenser and cooling tower, water-softening plant, &c., and minor additions to the generating station. It is estimated that the business is capable of very large extensions in all the suburbs, as Newcastle is the second city of the State, and its present business as regards electricity supply does not compare favourably with many smaller towns of the State. When it is known that Newcastle is practically in the centre of the coal supplies of the Commonwealth, and that it is rapidly becoming a large manufacturing centre, the possibilities become more apparent. It is also intended to adopt the very latest methods of obtaining business, and all classes of electrical apparatus will be hired in the manner that has been adopted by many English municipalities.

Barnes.—Acting on the suggestions of the engineer, the Electricity Committee recommends that (1) consumers residing in private houses and connected to the Council's electricity mains shall have the option of paying for energy at the existing prices, or as follows:—Where the energy used is for lighting purposes only, 10 per cent. per annum on the rateable value of the premises occupied by the consumer, payable quarterly in advance, plus 1d. for all units used as metered. Where the energy is for lighting and heating or cooking, or all three combined, 10 per cent. per annum on the rateable value of the premises occupied by the consumer, payable quarterly in advance, with an additional 1d. for all units used as metered during the months of October to March inclusive, and ½d. for all units used as metered during the months of April to September; (2) when the rateable value scheme of payment is in force no charge is to be made to the consumer for rent of meter. After discussion, these recommendations were agreed to, and the arrangement is to come into force after the March readings.

Barrow.—The T.C. has decided that application be made to the L.G.B. for sanction to the borrowing of £22,000 for electricity works purposes. The sum was detailed as follows:—Buildings, foundations, &c., £1,160; turbo-generator, rotary converters, steam pipes, &c., £7,270; high and low-tension switchboards and connections, £1,841; extra-high-tension mains and pilot wires, £8,627; sub-station switchgear and transformers, £2,075; engineering contingencies, £1,027. The Mayor (Ald. Smith) said probably not more than £10,000 would be required immediately.

Bingley.—The B. of T. has granted a prov. order for E.L. to the U.D.C.

Bolton.—Owing to the impossibility of having the new generating station at Back-o'-th'-Bank ready for next winter's load, a 3,000-ampere-hour battery is being installed, with an automatic booster, to overcome the peak load. The battery also will be used in connection with the tramway supply.

Bootle.—An inquiry has been held by the L.G.B. into the application of the Corporation for sanction to borrow £43,755 for the purchase of land and machinery for a new generating station. The borough electrical engineer (Mr. J. D. Clothier), in explaining the proposals, stated that the equipment of the station included two turbines capable of developing 3,000 KW. The new works, he said, would put the Corporation in a position to cope with any future requirements. No opposition was raised to the scheme.

Brazil.—The Government has granted to a syndicate the right to utilise the waterfalls at Braculy, in the Province of Angora dos Reis. The power available without storage reservoirs is 24,000 H.P., and with reservoirs as much as 100,000 H.P. The power will be used for electrometallurgical purposes.

Burton-on-Trent.—The T.C. has received the consent of the B. of T. to the use of overhead wires for the transmission of current in the outskirts of the borough, and along Bretby Lane, in the area of the Repton R.D.C.

Colchester.—The T.C. has decided to give a supply of current to the Lexden and Winstree B.G. for lighting at the workhouse.

Continental Notes.—Bulgaria.—The *Nachrichten fur Handel und Industrie* (Berlin) announces that a Bill has been submitted to the Bulgarian Legislature providing for an electrical installation at the "Pernik" State Colliery. The cost of the installation is estimated at £3,200.—*Board of Trade Journal.*

Portugal.—The Lisbon municipal authorities have decided to set up a central electric generating station for the purpose of supplying the city with electric light, and to lay the necessary cable. Tenders will be invited within a month.—*Board of Trade Journal.*

Turkey.—The municipal authorities of Monastir are at present considering a scheme for the construction of an electric lighting station and an electric tramway in the town. Water power will be utilised.

Austria.—The plans for a large power plant on the River Danube, near Pressburg, have been drawn up. The scheme contemplates taking the water direct from the river and leading it in a canal, 15·5 km. long, to the power house below Pressburg. The power house will be equipped with 16 Francis turbine groups, one being held in reserve; each group is expected to yield 4,000 H.P. at 75 R.P.M. The year's total output is reckoned at 300,000,000 KW.-hours. A supplementary high-pressure power station with accumulator equipment is planned to take the load of that portion of the distributing network supplying Budapesth.—*Zeit. fur das Ges. Turbinenwesen.*

Croydon.—At the last meeting of the County Council it was decided, subject to the issue of an Order by the B. of T., to supply electricity in bulk to the West Kent Electric Co., Ltd.

Dominica.—The Government has granted a concession to Mr. Lithgow, of 17, Madison Avenue, New York, to establish water and electric light services in the cities of Santiago de los Caballeros, Moca, La Vega, San Francisco de Macoris, and Puerta Plata. Power to the extent of 6,000 H.P. will be derived from the Yaque River, the turbine station being situated at a point 7 miles above Santiago.

Dublin.—When submitting its estimates for 1911, the Electric Lighting Committee estimated that at the close of the current year it would have a surplus of £6,788. This has, however, been realised only to the extent of £3,713, which is carried over to the account of the coming year, at the close of which the surplus is estimated at £13,304, which, added to this year's figure, makes a total estimated surplus on March 31st, 1913, of £17,017. The non-realisation of the figure which the Committee had hoped for in the current year was due to the falling off in the income from private consumers for the December quarter. The Committee's estimate was passed on the assumption that a reduction of 5 per cent. will be granted in the rates for energy for lighting as from April 1st next.

Doncaster.—In the estimates of proposed expenditure for the current year, £7,970 is set apart for extension of electricity mains and plant.

Eastbourne.—The Electricity Committee has received an application for a reduction in the present charges for power for cooking and heating, and the electrical engineer has recommended the following scale:—First 2,000 units per annum. 1½d. per unit; second 2,000, 1¼d.; remainder, 1d. per unit. The Committee has agreed, provided the applicant is willing to enter into a contract to have a supply for three years, and to pay for a minimum of 10,000 units per annum, to adopt the foregoing scale. With regard to a proposal to reduce the charge for motive power, the matter was deferred until the annual accounts of the undertaking have been published. The question of laying a new high-tension main for an alternative supply to Willingdon and Hampden Park, at a cost of about £962, has been deferred.

Fife.—During disturbances last week at the pits of the Fife and Lochgelly Iron and Coal Co., the electric power station came in for close attention from the strikers. In the station, of course, there is very valuable plant, and, as the floor was littered with projectiles, it is feared considerable damage must have been done.

Greenock-Port Glasgow.—An agreement has been reached between these towns whereby the former will supply power to the Port Glasgow shipyards. Permission is not to be given to erect a power station at Port Glasgow, either by the town or by private enterprise, until after 30 years from date of signing the agreement. The estimated capital expenditure by Greenock is put at £25,000, for cables, erecting a transformer station, &c.

Haiti.—The Government *Gazette* of Haiti publishes the particulars of a contract entered into with the Société Naitienne de Force Motrice. According to its terms the company is accorded a concession for 50 years for the generation of electricity from all the natural waterfalls and watercourses within a radius of 25 French miles from Petionville, which lies 10 km. from Port-au-Prince. The concession has to do with the electrification of the Port-au-Prince street tramways and the working of the projected Port-au-Prince-Petionville railway.—*Zeit. fur Turbinenwesen.*

Hazel Grove and Bramall.—The U.D.C. has now decided to assent to the Stockport T.C. supplying current to premises at Offerton, which is in the area of the U.D.C. Stockport had applied to the Board of Trade for an order without the assent of the U.D.C., and the assurances given to the latter body—which had intimated its intention of applying for a prov. order for E.L.—by the B. of T., have resulted in consent being given.

Hereford.—The Corporation has under consideration an improved lighting scheme for the centre of the city.

Heywood.—The Corporation on Thursday, last week, had to suspend the supply of electricity for users of power, and this affected between 60 and 70 works of various kinds. The stoppages of mills also increased, it being estimated that 4,000 people are unemployed in the town, as a result of the coal strike.

Leeds.—It will be remembered that at a recent inquiry of the L.G.B. into an application of the Corporation for powers to borrow £60,000 for electricity purposes, the Inspector strongly criticised the inclusion of sums in the suggested loan for service mains. The L.G.B. has since communicated with the Town Clerk on the matter, suggesting that in future the cost of such services and the purchase of meters should be provided out of revenue. The Finance Committee has agreed to act on the suggestion as from the end of March, and has decided to ask the Board to assent to the inclusion of the sum asked for in this special instance.

Limerick;—Mr. Cloran, borough electrical engineer, has submitted plans and specifications to the Electricity Committee in connection with the three different schemes put forward with regard to the improvement of the plant at the power station. It was decided to circulate copies of the report, and to consider the whole matter at a future special meeting.

Leith.—The Corporation electricity department has benefited from the coal strike. According to Councillor Craig, convener of the Electric Lighting Committee, the consumption has gone up, as consumers who generally used both steam and electric power turned to the electric motor in emergency. Mr. Craig also stated that while in some towns electric tramway services had to be curtailed, in Leith the facilities had been increased.

Lincoln.—The Electricity Committee has voted £1,000, being one-third of its profit, in relief of the rates.

London.—Hammersmith.—The Finance Committee has decided to carry the sum of £3,330, the estimated net surplus of the electricity undertaking for the year ending March 31st, 1912, to the relief of the rates. A further sum of £4,000, half of the accumulated surplus profits standing to the credit of the revenue account, is to be carried to the reserve fund. The Electricity Committee has decided to ask the Metropolitan Boroughs Standing Joint Committee to give consideration to the question of London electricity supply, upon which a Committee has been appointed by the L.G.C.

Lytham.—The B. of T. has informed the Council in respect of the proposed provisional order for supplying electricity that as the Lytham Electric Light and Power Co. failed to establish an undertaking under that order, the Board is not aware of any power under which that order could be revested in the Council. At the Council meeting, on April 4th, this was interpreted as meaning that the Council must apply for a new order next October.

Manchester.—The City Council has now decided to resume the normal supply of electricity on and after the 10th inst., and instruction has been given for the various firms to be notified to this effect.

New Zealand.—The Government having decided to abandon the Wairua Falls hydro-electric scheme, the Whangarei Council has resolved to apply for the use of the power for electrical purposes. It has been estimated that a revenue of £6,600 per annum would cover working expenses, and one concern is stated to have guaranteed to take £6,000 worth of energy per annum.

North Wales.—Various authorities are discovering the value of generating electricity by water-power, and steps are being taken to promote electric lighting schemes at Harlech and Llanhedr, in Merionethshire, the motive power being supplied by the waterfalls in the adjacent hills.

Nuneaton.—The T.C. has decided to apply to the L.G.B. for a loan of £3,770 for the following purposes:—Cable extensions to Griff Granite Quarry, £1,850; prospective expenditure on mains and services for three years, £1,750; excess expenditure, £170.

The Council has adopted the following alterations in the charges for current:—Large power consumers, first 5,000 units per quarter, 1d. per unit; next 1,000, ¾d.; next 4,000, ½d.; beyond 10,000, a flat rate of ¾d. for the whole supply. Current to licensed premises for lighting will be charged on a flat rate of 3½d. per unit provided the supply is used throughout, and that there is a minimum average quarterly consumption of 200 units.

Perth.—After considering the Loch Ericht Electric Power Bill, the T.C. agreed to take all necessary steps towards safeguarding the interests of the city in relation to the water rights, &c. A Committee was also appointed to visit the Loch and take levels of the water.

Peterborough.—Reports are under consideration by the T.C. for an extension of the borough boundaries, by taking in several villages, and one urban district in the vicinity. In this connection, the electrical engineer, in dealing with the electricity undertaking, suggests that the Walton district is already ripe for a public electricity supply, and advises the Electricity Committee to consider the advisability of installing at the existing generating station H.T. alternators, and a special main through New England to Walton, to supply all the large works adjoining the railways all the way from the River Nene to Warrington. The northern portion of the existing borough could also be supplied for lighting purposes from the H.T. plant, the current being converted to 200 volts D.C. He adds that the limit of D.C. distribution has already been reached in a northerly direction, and the question of supplying the extreme limits of the borough will have to be met whether the boundaries are extended or not.

Rochdale.—The L.G.B. has sanctioned the borrowing of £8,700 for extensions of buildings and plant at the electricity works.

St. Helens.—The Corporation Electricity Committee has decided to give a supply of current at 400 volts by means of overhead lines to the works of Baxter's Chemical Co., Bramwell's Chemical Works, and the British Electric Detonator Co.

The price of current supplied to the Technical School has been reduced from 4½d. to 3½d. per unit.

South Africa.—The increased consumption of electricity in Pietermaritzburg, due to the lighting of the new railway workshops, as well as increased demands by private consumers, has led the Council to consider the extension of the public generating plant. At the last meeting of the Council it was decided to install a steam turbine of the "Impulse" type, at an estimated cost of about £7,000, which would replace three of the present 60-KW. reciprocating sets.

In a recent month the consumption of electric current from the Durban power station for lighting purposes amounted to no less than 35 per cent. more than in the corresponding month of last year. So, also, is the power demand largely on the increase, the latest consumer being the Coronation Brick Works, some five miles out of town, which has installed two 300-H.P. motors, supplied at 6,600 volts three-phase from the new plant recently started up at the power station. It is hoped that by next month the whole of the railway and harbour load will be transferred to the municipal plant, the Government power station becoming a sub-station for distribution. It is apparent that there will be still greater increases in the immediate future, especially as the Corporation now has power to supply outside the borough.

Torquay.—An application has been received by the Electric Lighting Committee from the Works Committee asking for a reduction in the charge for lighting public arc lamps. Owing to the fact that the latter Committee is now getting the current at practically cost price, to the large expenditure incurred in converting lamps from carbon to metallic filament, and to the fact that lamps are now kept alight until midnight, the Electric Light Committee is unable to make any reduction in the price charged, but the engineer has been directed to prepare a statement with regard to the matter to be submitted to the Works Committee.

Uruguay.—The Finance Committee of the Uruguayan Legislature will shortly issue its report on the Government Bill for the nationalisation of the electric light and power service throughout the country. All towns with more than 4,000 inhabitants are to have power houses. This will mean a large purchase of plant, for which tenders will be invited.

Venezuela.—The Compania Generadore de Fuerza y Luz Electrica has been formed by a group of capitalists at Caracas and La Guaira, for the construction of a hydro-electric station at the Mamo Falls, 16 miles above La Guaira, in connection with the electric installation at La Guaira, which supplies that town and several neighbouring localities.—*Zeitschrift fur Turbinenwesen.*

Wallasey.—The minutes of the T.C. show that the Ferries Committee has had a scheme submitted by Mr. Marchant White, engineer, of Seacombe, for utilising the tides of the River Mersey for the generation of electrical energy to work the hydraulic lift at the Seacombe Ferry Stage and illuminate the promenade.

Windermere.—The U.D.C. has instructed the surveyor to obtain prices for wiring the Hospital for electric lighting. At present oil lamps are utilised.

Worthing.—In introducing the estimates for the coming half-year at a recent meeting of the T.C., the chairman of the Finance Committee mentioned that since the new oil engines had been at work he was authorised to say they had more than fulfilled the expectations of the Committee, and they quite anticipated that 12 months hence the undertaking would show a credit balance of £1,184. The economies which they were effecting by the new plant, and in other ways, would also enable the Electricity Committee to charge a flat rate of 4½d. per unit for public lighting instead of 5d.

TRAMWAY and RAILWAY NOTES.

Algeria.—Negotiations are proceeding for the construction of a system of electric tramways at Bona. This, says *African Engineering*, may be connected with a comprehensive scheme for the municipalisation of the waterworks, electric tramways, and electric lighting of the town.

Argentina.—Work on the electric tramway in Mendoza is being rapidly pushed ahead. *The Review of the River Plate* says that apparently a great mistake has been made by the Provincial Government in insisting that the gauge should be 5 ft. 6 in. instead of the standard 4 ft. 8½ in.

Bolton.—The Tramways Committee is spending from £1,500 to £2,000 on new machinery for the new repair shed, and deputations are visiting various towns for information on the subject.

Bradford.—The figures of the Corporation Tramways Department show that during the year just ended the approximate number of passengers carried totalled 56½ millions, as against 52,919,559 in the previous year. The mileage run increased by 223,000 miles, and the average receipts per car-mile were 11·92d., as against 11·60d. The total receipts amounted to £282,356, as against £264,075, an increase of £18,281. The number of through tickets between Bradford and Leeds was 291,396 (at 6d.) and 14,186 (half-fare), as against 254,236 and 12,171 respectively. The whole of the figures constitute a record for the city.

Bury.—At the Council meeting last week it was reported that the result of the year's working of the tramways undertaking was a net profit of £8,575. The number of passengers had increased from 13 millions to 14¼ millions, and the receipts from £60,000 to £66,000, though the working expenses had only been increased by £500. A reserve fund of £20,000 has been built up. It was decided to carry £3,575 to the reserve fund and place the balance of £5,000 to the credit of the borough rate.

Continental Notes.—Germany.—A scheme for the construction of a light electric railway between Klingenthal and Untersachsenburg, Saxony, is at present under consideration.

France.—Plans are being prepared in respect of a projected electric railway between Vitrz-le-Francois and Brehan (Marne). The power station, of 600-H.P. capacity, would be situated at Larzicourt.

Russia.—A scheme for the construction of an electric tramway in the town of Perm is at present under consideration.

Exeter.—The year ending 31st ult. has been a record one for the Corporation tramway undertaking. The passengers carried numbered 4,244,671, as compared with 3,974,142 in the previous year. The cars ran 429,878 miles, compared with 426,993 miles, whilst the receipts were £17,290, against £16,165. The earnings per car-mile were 9·65d., against 9·08d.

Fife.—Owing to the failure of the electric supply, the Wemyss and District Tramway system, which covers about eight miles, and connects a number of important towns, was partly closed down for 48 hours last week. The Kirkcaldy authorities supplied energy to the section to East Wemyss, which was kept running, but Buckhaven, Methil and Leven were isolated.

Glasgow.—One of the most remarkable features of the coal strike, so far as Scotland is concerned, is the daily increase in the amounts taken on the Glasgow Corporation cars. The average increase per day has been about £100.

Halifax.—The report on the working of the tramways for the year ending March 31st shows that there is a net profit of £17,293, as against £11,500 last year, and £13,065 in the previous year. Of the total income of £101,893, £98,115 was derived from passengers, £794 from private cars, &c., £2,047 from parcels traffic, and £937 from advertising. The chief items of expenditure in the total of £84,600 are traffic expenses, £25,400; general expenses, £1,683; repairs and maintenance of permanent way, £6,986; ditto, overhead equipment, £1,455; cars and meters, £5,694; rates, £2,415; accident insurance, &c., £1,290; power, £16,769; parcel traffic, £737; interest on loans, &c., £10,550; sinking fund, £10,197; Parliamentary expenses, £250. The total number of passengers carried was 18,749,456, compared with 17,067,865 for the preceding 12 months.

Ilkeston.—The T.C. has adopted a new scale of charges for electricity for lighting and power purposes, also a new and increased scale of tramway fares. Several members opposed increased tramway fares, on the ground that when a similar proposal was previously put into effect, the public boycotted the cars. It was, however, stated that the tramways manager staked his reputation on an increased revenue by the adoption of the new scale, and in the end the proposals were adopted.

Jamaica.—In the House of Commons last week, Mr. Amery asked the Secretary of State for the Colonies whether he could give any information with regard to the interference of the populace in Kingston, Jamaica, with the running of the electric tramway service in that city; and whether it was a fact that the Colonial authorities had declined to afford the tramway company the police protection necessary to enable it to run its service.—Mr. Harcourt, in reply, said that he had no official information as to further interference with the tramway since the riot which was reported in the Press at the time. He had asked the Governor by telegraph to report as to any further developments which might have taken place.

Liverpool.—The City Council on April 3rd received the engineer's report on a proposal to construct a single line along Ulbet Road, thus connecting Smithdown Road and Aigburth routes at the Dingle. The capital expenditure to construct this line would amount to £12,386. Added to this would be the cost of three cars, £1,800, making the total £14,186, which would involve an annual charge of £944 for interest and sinking fund, and £2,613 for operating charges. Taking the earnings on the basis of 7d. per car-mile, and assuming that 80,000 miles annually would be run, the total receipts would amount to £2,333, making a deficit £1,224 per annum on the operation of the line, without allowing for reserve, renewal, and depreciation. Regarding another proposal to construct a line between Aigburth Vale and Smithdown Road, *via* Ibbotson's Lane and Greenbank Road, the engineer estimated that the cost of constructing it would be £14,586, and adding £2,400 for four cars, a total capital expenditure of £16,986. As this road was not yet constructed, the Tramways Committee was of opinion that it was desirable to postpone consideration until such time as the roads were completed. Sir Charles Petrie (chairman of the Committee) said they hoped some day when the Queen's Drive was completed across Mossley Hill, which would go into Aigburth Vale, to make a belt route in that neighbourhood. Until then he hoped the Council would not force the Committee to do anything in the nature of the proposal put before them. The Council decided not to authorise the construction of these lines at present.

London.—The work of converting the East London Railway for electric traction has been started and, it is expected, will be completed in a few months.

Madagascar.—According to *African Engineering*, it is proposed to construct an electric railway between Fianarantsoa and the Port of Mananjary.

Manchester.—The City Council has decided to sanction the Tramways Committee's scheme for extending the stages on the tramways, and the city now equals Sheffield in the length of the ride given for 1d., and it far exceeds every other centre for the cheapness of workpeople's fares. The new rates come into operation forthwith, and further extensions consequent on the above alterations are promised.

Nelson.—At the T.C., on April 4th, the Electricity and Tramways Committee reported the receipt of a letter from the Colne and Trawden Light Railway Co., suggesting through running of Burnley cars over the systems of Nelson Corporation and the company. The suggestion was not entertained.

Newcastle-on-Tyne.—The total receipts on the tramways for the year ending on Sunday were £223,500, this being the largest on record. Out of the revenue during the year £12,000 was given to relieve the rates, and £12,250 was paid to the Newcastle Electric Supply Co., to enable the Corporation to supply power to its cars in the Walker district.

Rotherham.—In forwarding its approval of the plans of the extension of the Dalton tramways to Thrybergh, the B. of T. states that, in view of the severe gradient at the commencement of the tramway, it will be necessary, prior to offering the line for inspection, to provide some method of signalling, and that all cars travelling on the new tramway shall be equipped with a track brake, capable of mechanical application during the descent of the gradient.

Stretford.—The General Purposes Committee has decided to make application to the Board of Trade for an extension of time for a further period of four years for the construction of light railways authorised by the Stretford Light Railways Order, 1906, and Railway No. 10, West Manchester Light Railways (New Lines, &c.) Order, 1906, in order to synchronise with the extended powers for the construction of tramways authorised by the Manchester Southern Tramways Act, 1903, and the Stretford U.D.C. Act, 1904.

Tasmania.—The Government has under consideration a scheme for operating the Huon Valley Railway on the single-phase system. The route is 35 miles in length, and the project has been reported on by Mr. W. G. T. Goodman.

The tramway system of Launceston is to be extended at a cost of £10,000.—*Commercial Intelligence*,

U.S.A.—A new type of safety tramcar has been introduced on to the streets of New York, which is the joint invention of Mr. F. Hedley and Mr. J. S. Doyle, of the New York Railways Co. According to the *Standard*, it is shaped somewhat like a torpedo, and is 40 ft. long. The extremities are rounded, and the wheels are encased, causing the car to appear to be sliding along the track. There is no front or rear platform, passengers using a side door, and entering directly from the street into the car. There are no steps whatever, the body of the car being only 10 in. above the roadway. The conductor sits at one side behind a miniature desk. The side door is worked automatically, and cannot be opened while the car is in motion, and the car itself cannot be started until the door is closed. The seating capacity is 50 passengers, and there is standing room for 30 more. Fresh air is provided by eight automatic ventilators. A device, controlled by the weight of the persons inside, registers the amount of air entering through the ventilators. During the winter the air is heated before it enters. The car is operated by the motorman from an enclosure in front, but an emergency device permits the

conductor to stop the car from his desk by turning a lever. An automatic fender applies the brakes immediately the car strikes a pedestrian or any other object.

Venezuela.—The Government has granted a concession to Felipe Guerra to construct an electric railway from the Orinoco or the Coroni to Callao. The concession includes the right to use the waters of the Coroni Rivers or of the Canon del Toro for the generation of electric power for the use of the railway and for industrial purposes.—*Elek. u. Masch.*

West Hartlepool.—It was stated at the last meeting of the T.C. that the Corporation is at present losing on the Park and Foggy Furze sections of the tramways, £12 or £14 per week. It was explained that the sections had been acquired by the Corporation and were being run for the Corporation by the tramways company.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Australian Wireless Co., Ltd., is issuing a writ against the Adelaide Steamship Co., as users of the Marconi wireless system, for an alleged infringement of the patent rights of the former in Australia. The company has also decided to issue a writ against the Maritime Wireless Co. (Shaw System), Ltd., as manufacturers of the apparatus of the Melbourne Government station, for alleged infringement of the patent rights of the company.—*Australian Mining Standard.*

Cable Communication with Canada.—In the House of Commons last week the P.M.G. said he was aware that the Canadian House of Commons had expressed a desire for cheap and easy communication with the United Kingdom, but he did not see his way to demand further rate reductions at present, nor could the Government grant a subsidy towards the formation of a cable company by British subjects. In February the Press sent more telegrams to Australia at the deferred rate of 4½d. than at the urgent rate of 9d. He had entered into an agreement with the Marconi Co. for the erection of a chain of wireless stations between this country and India, Australia and New Zealand, at a cost of half a million, which would place Great Britain far in advance of any other country in respect of wireless telegraphy.

Police Telephones.—According to the *Daily Chronicle*, the Berlin police are all provided with pocket telephones, and connection boxes are fixed in every street, so that communication can be immediately effected with headquarters. The pocket apparatus fits into a nickel case 2½ in. in diameter × ¾ in. thick, and weighs only 7 oz.

Post Office Engineering Staff.—Last week Mr. Snowden asked the P.M.G. whether, in connection with the recent reorganisation of the engineering department of the Post Office, 32 second-class engineers who entered the Post Office service from the Universities, and whose average length of service was two years, had been assigned to the new class of assistant engineers over the heads of 112 non-University second-class engineers of proved executive and technical ability, with average Post Office service of 22 years; whether he would give particulars of the qualifications required for the position of an assistant engineer, and the tests the University men were subjected to in order to demonstrate their executive ability, and in what respects they were found to be superior to the engineers whom they passed over.—Mr. Herbert Samuel replied that the new class of assistant engineers comprised those officers of the late second class of engineers, numbering 271, who, in the opinion of the engineer-in-chief, possessed the qualifications required for the new class. This new class consisted of 209 officers, among whom 32 were trained at various Universities and 177 were not. All the University officers were successful candidates on their entrance to the Post Office service in a competitive technical examination conducted by the Civil Service Commissioners, the standard of which was much higher than that by which the second-class engineers entered. Great care was taken in the selection.

Postal Servants' Conference.—The annual conference of the United Kingdom Postal Clerks' Association was held on Monday at Bristol. The president, referring to the relations between the Association and the Department, pointed out that the subject of a strike policy had been introduced into the agenda. A motion to affirm the right of postal workers to withdraw their labour in support of just demands was defeated by 98 votes to 47.

Russia.—The Government proposes to establish four wireless stations on the shores of the Kara and White Seas, at a cost of 100,000 roubles, to facilitate commercial intercourse between Siberia and Europe by way of the Arctic Sea.

United States.—The abuse of wireless telegraphy in the United States has grown to such a pitch that the Government has at last been compelled to initiate legislation, insisting upon the licensing of all wireless installations and operators. The multiplication of private stations, and the development of the wireless hobby, has caused serious interference with commercial and official communication, and the practical joker has commenced issuing false alarms, calling for aid to fictitious shipwrecks and similar follies.

The enmity between the Postal Telegraph Co. and the Western Union Telegraph Co., which fiercely compete for the telegraphic business of the country, has been intensified by the allegation that the Western Union is in league with the Bell Telephone Companies to divert traffic from the Postal Telegraph to the Western Union lines. When telephone subscribers call for the Postal Co., in order to telephone messages for transmission by telegraph, the exchange, it is alleged, connects them with the Western Union office instead of the Postal Co. The charge is denied by the Western Union, but is pressed by the Postal Co., which is applying to the Public Service Commissions for relief.

Wireless Rescue.—Once more wireless telegraphy has played a useful part in saving life at sea. The ss. *Ontario* caught fire on Monday night, and as the fire got beyond control, aid was summoned by the wireless operator. The vessel was beached, and the passengers were rescued by coastguards. The crew of the vessel eventually succeeded in subduing the flames.

Wireless Telegraphy.—M. Turpain has presented a communication to the French Physical Society regarding the graphic recording of signals transmitted by wireless telegraphy. He claims to have succeeded in recording by automatic apparatus the time signals emitted from the Eiffel Tower, at a station at Portiers, 300 km. away, but has not been able to record messages.—*L'Electricien.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—The T.C. has decided to invite offers for a new generating plant at the electricity works; estimated cost £6,200.

Ashton-under-Lyne.—May 1st. Two sets of counter-current jet condensing plant with steam-driven pumps, and one natural draught wooden chimney cooler, for the Borough Electricity Department. See "Official Notices" to-day.

Australia.—Victoria.—April 23rd. 2,000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" March 1st.

May 1st and 8th.—Cable for P.M.G.'s Department.

May 14th.—Telephones, switches, condensers and protectors, for Melbourne. See "Official Notices" March 22nd.

May 15th.—Electric vehicles for the Electric Supply Committee of the City Council of Melbourne. See particulars in this column last week.

May 21st.—P.M.G., Melbourne. 30 miles of cable, 24½ miles of cable, 699 non-polarised relays. See "Official Notices" to-day.

July 23rd,—P.M.G., Melbourne. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

Queensland.—April 24th and May 8th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" March 15th.

May 8th.—Telegraph and telephone instruments, switchboards and accessories, measuring instruments and protectors, for the P.M.G.'s Department. See "Official Notices" March 22nd.

Western Australia.—May 8th. Common-battery telephones, for the P.M.G.'s Department. See "Official Notices" March 22nd.

Tasmania.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

N.S.W.—Three centrifugal pumps (12,000 gallons per minute), five 350-kw. transformers, A.C. motors, for White Bay power house, for N.S.W. Government Railways and Tramways Department. Electrical Engineer's office, 61, Hunter Street, Sydney.

Austria.—Vienna.—June 10th. Tenders are invited for the supply of 9,600 telephone wall instruments, 4,200 telephone table instruments, and 1,100 telephone desk instruments, for single connections to the central battery system, and 4,000 telephone wall instruments for company connections to the central battery system. The supplies may, at the option of the Minister of Trade, be either increased or lessened by 20 per cent. Particulars, Postökonomieverwaltung, the Börseplatz, Vienna.

Bolton.—April 25th. Materials and stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Bosnia.—Sarajevo.—The T.C. is about to call for the supply of a transformer, estimated to cost 40,000 kronen, for the municipal power station, and a freight electric locomotive (28,000 kronen, estimated); also for vacuum brakes (4,000 k., estimated).

Bray (Ireland).—May 7th. One 150-B.H.P. Diesel engine, coupled to a 100-kw. alternator and exciter, and one 7½-ton overhead crane, for the U.D.C. See "Official Notices" to-day.

Dublin.—April 15th. Flame arc lamps and suspension gear, for the Corporation. See "Official Notices" March 29th.

Felixstowe.—April 22nd. Replacing 40 arc lamps by glow lamps, for the U.D.C. See "Official Notices" to-day.

Italy.—Gallarate.—April 23rd. Supply of an 11-ton portable bridge crane. Particulars of the Direzione Generale, Ferrovie dello State, Rome.

Leeds.—April 20th. Eight miles of ·2 sq. in. three-core cable, 6,600 volts, for the City Council. See "Official Notices" April 5th.

Lincoln.—May 6th. One 1,000-H.P. Diesel oil engine, coupled to a continuous current dynamo, or two 500-H.P. Diesel engines, with continuous current dynamos; one 120-KW. motor-generator and one switchboard, for the Corporation. See "Official Notices" to-day.

Lisbon.—The T.C. having decided to erect its own municipal station and distribution system, tenders will be invited within a month's time for the necessary materials, &c.

London.—L.C.C.—April 16th. Electrical installation at the Lyham Road School. See "Official Notices" March 29th.

St. Pancras.—April 15th. Lead-covered armoured cables, for the B.C. See "Official Notices" March 22nd.

H.M. Office of Works.—April 17th. Conduit boxes for two years. See "Official Notices" March 29th.

Hammersmith.—Tenders are to be invited for the supply of 14 steam traps, also for the supply of six testing instruments for the provision of testing stations as required by the L.C.C.

New Zealand.—May 1st and July 1st. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of pipe lines, valves, water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. The sections to be tendered for by July 1st are:—Lightning arresters, insulators, bare conductors, insulated cables, pole switches, testing transformers, supply meters, batteries and accessories. Particulars can be seen at Board of Trade Com. Int. Dept. in London. Tenders for the whole, or for any section, should be addressed to the Minister of Public Works, Wellington.

Rhodesia.—Salisbury.—April 15th. (1) Cables, poles, and line material; (2) power station equipment for lighting. London agents: Davis & Soper, 54, St. Mary Axe, E.C. Deposit £5. Must be British or British-Colonial manufacture.

Salford.—April 17th. Tenders are required for repairs to two chimneys at the electricity works. Borough Electrical Engineer, Frederick Road.

April 22nd.—Electrically-operated travelling jib crane, bulk weigher, and tray conveyor, for the Corporation Electricity Department. See "Official Notices" to-day.

San Francisco.—May 8th. The Board of Public Works invites tenders for the supply of 43 tramway cars for the Geary Street municipal tramway. Deposit 10 per cent. Specifications and forms of tender may be obtained on application to the City Engineer, San Francisco. Specification, form of tender and drawings may be seen at the Commercial Intelligence Branch of the B. of T. in London.—*Board of Trade Journal.*

South Africa.—Johannesburg.—The *British and South African Export Gazette* for April states that electricity consumers in Johannesburg are increasing at such a rapid rate, the average number of new connections being nearly 200 per month, that the Municipality's stock of meters has become very low, and further supplies, chiefly of "two-rate" type, are rendered necessary.

Cape Town.—May 15th. Two electric passenger lifts for new Law Courts. Specifications, &c., from District Engineer, Public Works Dept. Deposit £2.—*Board of Trade Journal.*

A copy of the specification may now be seen at the Com. Int. Department of the Board of Trade in London.

May 9th.—Our Durban correspondent writes:—Owing to the extended use of electric current within the city of Cape Town and the adjoining municipalities, &c., the City Council has authorised tenders to be invited for the supply of additional plant, among which may be mentioned:—

1. A steam turbine-driven alternator and converter, the turbine to be capable of giving a continuous output of 2,000 K.V.A.
2. High and low-tension switchgear and transformers.
3. Approximately 24,750 yards of K.H.T. three-phase cable, joint boxes and disconnection pillars.
4. Green's economiser.

Tenders are to be deposited at the City Hall, Cape Town, not later than May 9th, 1912, excepting for certain switchgear and transformers, for which tenders were to be in on March 25th.

Southend-on-Sea.—Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Walsall.—April 22nd. Seven tramcar bodies, with trucks and equipment, for the Corporation. See "Official Notices" March 29th.

West Hartlepool.—April 15th. High and low-tension switchgear, for the Corporation Electricity Department. See "Official Notices" March 29th.

Wigan.—April 22nd. Construction of 700 yards of single-track tramway (including three short passing places). Borough Engineer, King Street West.

CLOSED.

Accrington.—The Electricity Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for one double-deck car and one single-deck car, at the price of £746 and £696 respectively.

Ashton-under-Lyne.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for 10-ampere meters for the ensuing year.

Atherton.—The U.D.C. has accepted the following tenders:—

British Electric Transformer Co., Ltd.—Two oil-cooled transformers.
Cal ender's Cable and Construction Co., Ltd.—1,000 yd. high-tension cable, and 1,000 yd. earthenware troughing.

Australia.—The following contracts have been placed, according to the *Australian Mining Standard*:—

Queensland.—P.M.G.'s Department:—

85 switchboards, common-battery, at £9 15s. each; five ditto, at £14 17s. each; one switchboard, 120 lines, at £67 10s.; two switchboards, magneto, at £15 each; 80 switchboards, magneto, at £6 each; 20 ditto, at £8 10s. each; 10 ditto, at £9 3s. each; 20 ditto, at £12 16s. 3d. each.—Western Electric Co. (Australasia), Ltd.
27 switchboards, magneto, non-multiple, 100 lines, at £89 11s. 8d. each.—British Insulated and Helsby Cables, Ltd.
1,417 iron or steel poles, at 32s. 6d. each.—Siemens Bros. Dynamo Works, Ltd.
61 poles, tubular, iron or steel, 24 ft., at 59s. 4½d. each; 616 poles, 26 ft., at 70s. each; 173 poles, 30 ft., at 110s. 9d. each.—Stewarts & Lloyds, Ltd.

Footscray (V.).—City Council:—

Three transformers for electric supply undertaking, £309.—Australian Metal Co.

Prahran and Malvern Tramways Trust (V.):—

1,272 tons of 60-ft. steel rails, at £6 13s. per ton.—R. W. Cameron & Co.

Sydney.—City Council:—

Arc lamp brackets, £5 2s. each.—W. Elder & Co.
Oil switches (10,000 volts), £1,240.—Australian General Electric Co.
5,000 volt switchgear, transformers, &c., £1,454.—Noyes Bros.
Transformers, £1,314.—Noyes Bros.
10,000 volt switchgear and transformers, &c., £4,611.—Noyes Bros., provided the firm is prepared, without added cost, to supply a type of inverse time-limit relay apparatus to be specified by the city electrical engineer.
Lightning arresters, £30 5s.; earth detectors, £35 10s.; line switches, £2 10s.—Australian General Electric Co.
1,000-K.V.A. transformers, £1,230.—Australian General Electric Co.
Wright's M.D. indicators for the year (Reason Manufacturing Co.).—W. G. Watson & Co., Ltd., 3-amp., £115; 5-amp., £115; 10-amp., £2.0; 25-amp., £255; 50-amp., £230; 100-amp., £62 10s.

Victoria.—P.M.G.'s Department:—

480 trembling bells, £78; 200 common battery wall telephones £367; 200 common battery wall telephones (residence type), £275.—British General Electric Co., Ltd.
550 rolled-steel beams, at 42s. 6d. each, £1,361; 2,200 rolled-steel beams, £6,352.—Dorman, Long & Co., Ltd.
3,000 four-conductor telephone cords, £156.—British General Electric Co.
4,000 yds. submarine telephone cable, at £278 per nautical mile, £548.—Siemens Bros Dynamo Works, Ltd.
10 tons galvanized steel wire, at £16 4s. per ton, £162.—W. S. Hill.
43,000 steel spindles at 3½d. each, and 10,300 at 9d. each, £1,013.—Williams and Co.
11 tons bronze wire, at £87 1s. 9d. per ton, £958.—Gibbs, Bright & Co.
Copper wire, resistance sets, rheostats, total contract £5,970.—British Insulated and Helsby Cables, Ltd.

South Australia.—P.M.G.'s Department:—

Switchboards for private branch exchanges, &c.—J. Bartram & Son Pty., Ltd.
25 miles wire, 40 miles wire, 17 miles wire, 3 miles wire.—W. T. Henley's Telegraph Works Co., Ltd.
10,000 insulators, shackle, large porcelain, at 4½d. each; 10,000 insulators, porcelain, at 4½d. each.—Dalgety & Co.
55,000 insulators, at 1½d. each.—Western Electric Co. (Aust.), Ltd.
5,000 insulators, at 1·25d. each.—Steele & Baker.

Barrow.—The T.C. has accepted tenders as follows:—

Engine and crank chamber oils.—Jas. Light & Son, Ltd.
Cylinder oil.—A. Duckham & Co.
Colza and boiled linseed oils, &c.—Burnip & Macdougall, Ltd.
Copper wire.—Thos. Bolton & Sons, Ltd.
Shellac varnish, &c.—W. Drysdale.
Electric stores.—Baxendale Bros.
Arc lamp carbons.—Ship Carbons, Ltd.
Arc lamp globes and shades.—The City Glass Co.
Switch cut-outs.—British Insulated and Helsby Cables, Ltd.
Electric meters.—Chamberlain & Hookham, Ltd.
Electrolytic midget meters.—Reason Manufacturing Co., Ltd.
Tantalum and other lamps.—Drake & Gorham, Ltd.
Earthenware pipes.—Doulton & Co., Ltd.
Pavement covers.—W. T. Henley's Telegraph Works.
Rubber gloves.—Siemens Bros. & Co.
Galvanized tubing and steel conduits.—Simplex Conduits, Ltd.
Brass saddles and pins.—General Electric Co., Ltd.

Bedford.—Messrs. W. S. Wilton & Co. have secured the contract for the wiring of Messrs. Blake Bros.' Empire Picture Palace in Midland Road.

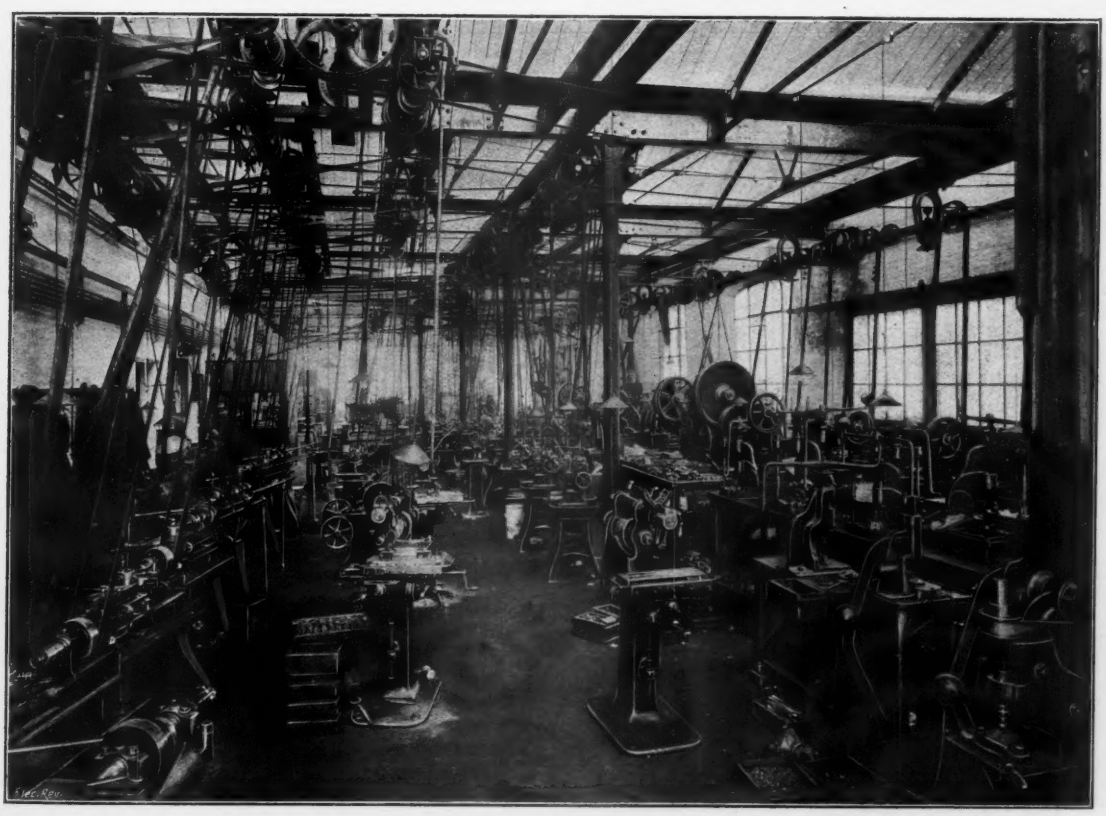
(*Continued on page* 591.)

THE STERLING TELEPHONE WORKS, DAGENHAM, ESSEX.

We recently had the pleasure of paying a visit to the works of the Sterling Telephone and Electric Co., Ltd., at Dagenham, Essex, on the invitation of Mr. Guy Burney, the managing director. The works are pleasantly situated in the country amongst the strawberry fields, where rents and rates are low; but they are easy of access from London, and within range of a large and industrious population. It is now about 2½ years since the company purchased the site, upon which some excellent buildings had been erected and equipped with shafting and power plant by the late Morris Aiming Tube and Ammunition Co., Ltd. The buildings lent themselves admirably to the purposes for which the Sterling Co. required them, and were soon occupied to the full; but the accommodation proved insufficient to cope with the demand for their products, and it became necessary to carry out extensions on a considerable scale. The new buildings have now been finished, and are being brought into use as the necessity arises; the power plant has also been more than doubled in capacity, in order to cope with the increased load.

Bird's-Eye View of the Sterling Telephone Works, Dagenham.

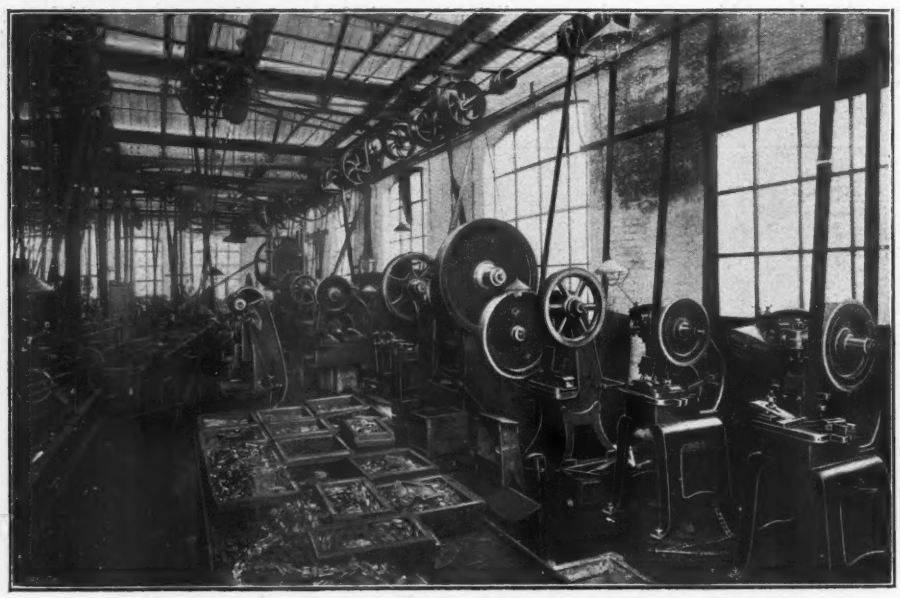
A general view of the works is given in the accompanying illustration. The site includes an area of some 11 acres, providing ample facilities for future extensions; the buildings are almost all of one storey, with saw-tooth roofs and north lighting, and are very substantially constructed.



No. 1 Machine Shop.

F

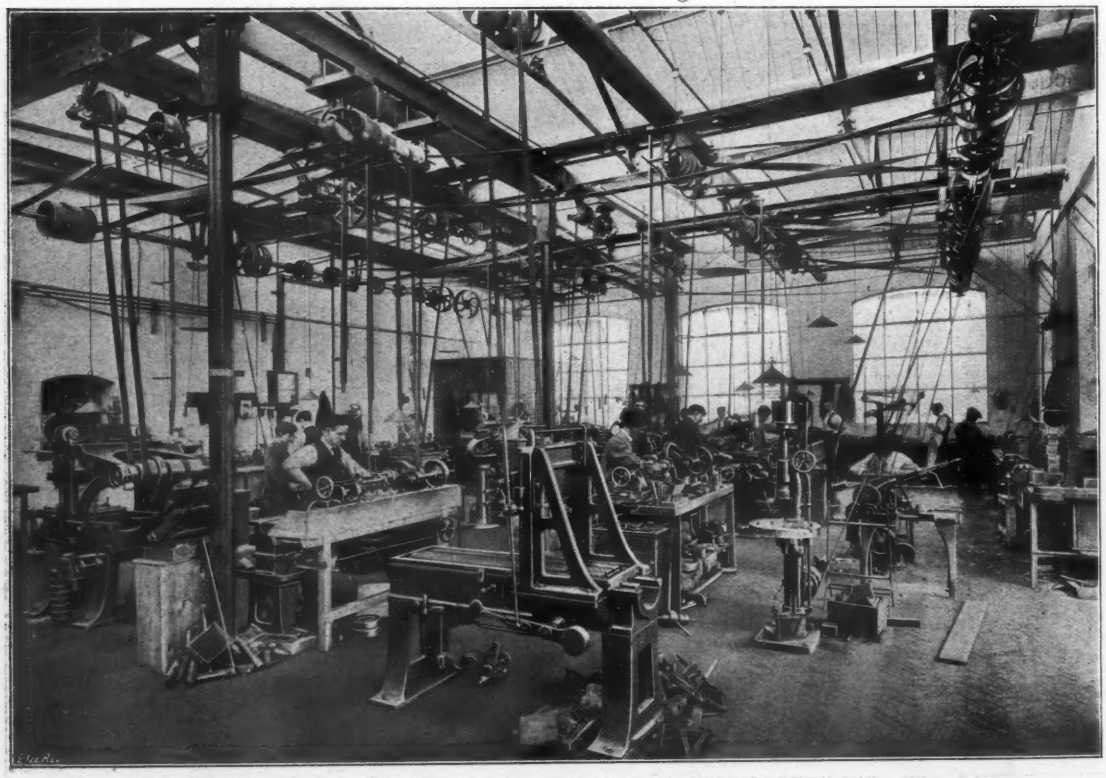
Power for driving all the machinery, and for the bulk of the lighting of the works, is derived from an engine room containing two horizontal Tangye gas engines, of 45 and 65 H.P.



Power Press and Automatic Department.

respectively, driving by belt Morris-Hawkins dynamos, and a vertical Campbell four-cylinder engine of 120 H.P., directly coupled to a Phœnix dynamo (p. 590). The last-named set is able to carry the whole load when required. These generating sets are housed in what used to be a steam engine room; the engines and boilers were removed, and the room partly rebuilt and provided with a new roof. The main switchboard controlling the whole works is fixed close to the wall at the rear of the engine-room. Two Tangye suction-gas producers and a Campbell producer, fed with anthracite, provide a supply of gas for the engines, and require very little attention. The engines also have given great satisfaction.

Taking the various shops in order, we may begin with the tool-making department—a very important one, for the company make all their own punches and dies, and similar special tools, which involve a vast amount of painstaking labour and a very considerable admixture of brains. The art of milling is here developed to a high degree of accuracy and finish—some tools being completely finished on the milling machine—but as far as possible each workman specialises in his own class of work, and thus a tool passes through several hands in the course of its evolution. A useful tool in this department is a fret-saw capable of cutting out steel dies, &c., $1\frac{1}{2}$ in. thick; the saw is 50 ft. long, the spare length being coiled up on the machine, so that it can be fed out as required. Many of the dies, punches, and jigs are of extremely complicated shapes, the aim being to render each operation as far as possible automatic, and to reduce the amount of labour required. A small store of such special



Tool-Making Department.

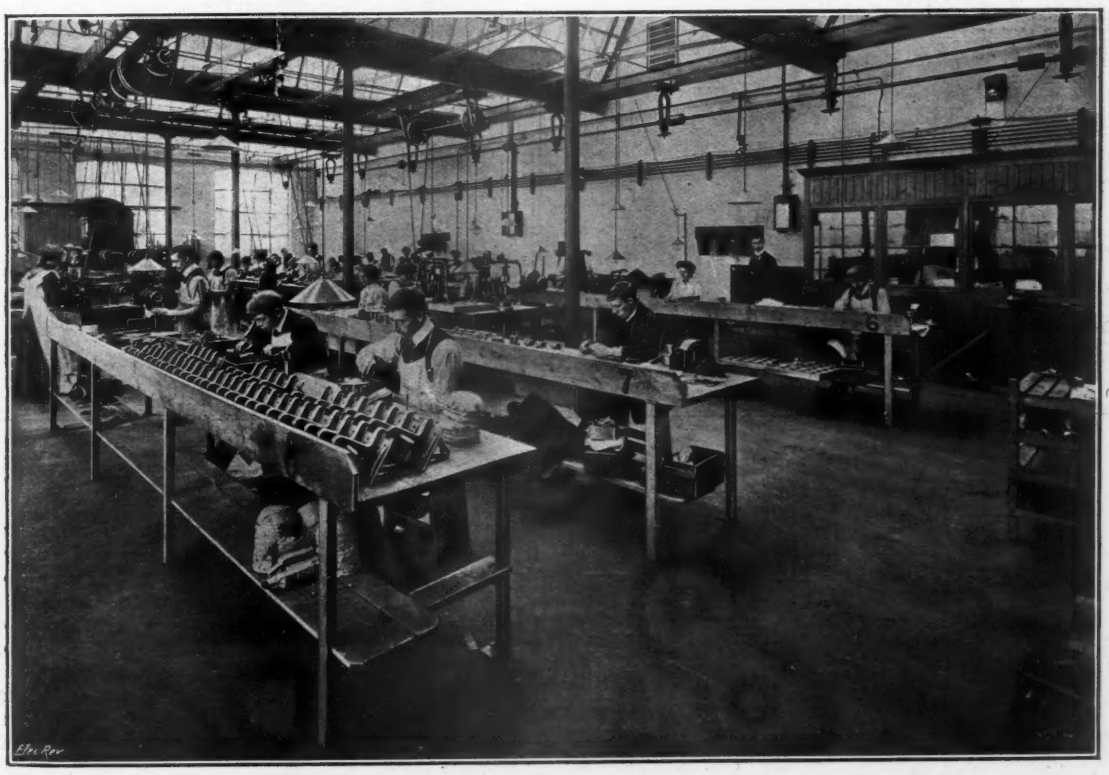
tools,' in a corner of the department, contains material worth many thousands of pounds.

Passing on to the machine-shop (No. 1), we may note that the tools are wholly group-driven, from countershafts. The

No. 1 Assembly Shop.

motors—two in number, of 20 H.P. each—are situated in the roof, to economise space. A large number of presses, some of them very heavy, are installed in this shop, a great proportion of telephone and similar work consisting of stamping and pressing metal parts. The brass cases for the familiar G.P.O. Bell receivers, for example, are drawn into their final shape by successive operations from an initially flat plate, the metal being annealed after each drawing. Finally, after the receiver has been drawn into the shape of a closed cylinder with a bell mouth, the closed end is bulged out to a larger diameter than the barrel, by a special process devised by the company's staff for the purpose. The safety device for presses, which consists of an arrangement necessitating the use of *both hands* to start the press, is worthy of mention, as it renders an accident to the operator's hand quite impossible. Besides these operations, others, such as grinding to exact dimensions, drilling, turning, &c., are carried on in this shop. The annealing shop (shown overleaf), to which constant recourse is necessary, opens into one end of it, and contains a large annealing furnace fired with coal, as well as a hardening furnace for steel magnets, which are made in thousands at a time. An electric pyrometer is used for determining the temperature at which these operations are carried on.

We give on p. 590 an illustration of the buffing and polishing and grinding shop. This is provided with a powerful air-exhausting system, which draws off all the dust and discharges it into a dust-catcher. Next comes the pickling and depositing shop, where copper and nickel-plating is carried on; several improved processes are in use here, of which more will be heard in the future. All iron castings are here given a coating of deposited copper before painting, to ensure freedom from rust.



Part of No. 2 Assembly Shop.

An entirely new building has been erected for the

lacquering department. To ensure a perfect finish, this room must be kept at a uniform temperature, dust-proof and free from condensation of moisture. The lacquering room therefore is entered through double doors; it is lined completely with white enamelled brick, and is of entirely fireproof construction. The air supply is filtered, and is warmed before it is admitted to the room—or cooled, according to the season. Water pipes are provided round the walls, with which the latter can be washed down. With the aid of these precautions, and by taking infinite pains, the company has succeeded in mastering the difficult problem of securing a perfect black enamel finish. A large and well-equipped stove room is provided.

Close by are the raw-material stores. At the time of our visit, thanks to the coal strike, the stock of raw material had run down to a point which threatened the necessity of a partial or total cessation of work for want of stuff—not for want of coal, of which there was plenty in hand. Now, however, the crisis has been safely passed without more than temporary inconvenience. There is also an "intermediate store," into which all work is sent between successive operations, to be inspected, if necessary, and checked.

We come next to No. 2 machine shop, which is situated in one of the new buildings. This contains a large equipment of automatic machines, making screws and other small parts, of which huge quantities are used in the construction of telephones and bells. Semi-automatic machines, wood-drilling machines, &c., are provided, and are being added to as the need arises. Close by is the experimental department, where new designs are worked out, and special batches of apparatus in small quantities, not sufficient to justify their being handled in bulk in the ordinary way, are dealt with. Here, for instance, indicators, large watertight bells, and similar items are made.

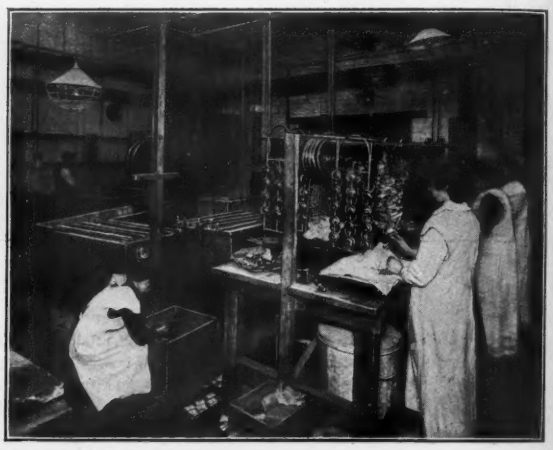
In the "small assembly" department receivers, transmitters, bells and such like apparatus are assembled—not forgetting the "Parlyphone," which has maintained its popularity, and is made in large batches. Some automatic drills in this department call for notice; the act of feeding the drill—or rather, raising the platform—sets the drill in motion, a small motor providing the driving power. Economy of energy and time is thus ensured, as the drill is never running except when it is drilling, while it is always ready the moment it is wanted. In the adjoining coil-winding department, induction coils, receiver coils, &c., are made and tested. They are wound by machines driven by hand or motor, with great dexterity by the operatives.

The principal assembly shop (No. 1 assembly department) is accommodated in a new building, where all sorts of instruments are assembled, from the cheap battery set to the G.P.O. standard central-battery instrument.

A separate building has been erected for storing the "piece parts"—that is, the finished components, which are drawn upon as required for orders in progress. Here, in countless compartments and pigeon-holes, are stored about ten million separate parts, worth in the aggregate some £30,000. A large proportion of this stock consists of telephone apparatus for the Post Office, which has been completed and is awaiting removal; a Post Office inspector is constantly at work, examining and testing the apparatus destined for his department, and large numbers of receivers, transmitters, bells, wall sets, &c., are passing through the shops. The company does not concern itself at present with the construction of large exchange switchboards, but manufactures all kinds of telephones for public and private use, including, of course, the "Primax" central-battery intercommunication telephones, mining telephones, bells of all sorts, magneto-exploders—in fact, almost all the instruments, &c., with which its name is associated, 95 per cent. of its products being made at Dagenham.

All the apparatus has to pass through the testing shop, where the whole of the finished material is examined and tested ready for dispatch—the testing, in the case of telephones, including an actual "*viva-voce* examination."

Engine room.



Plating shop.

Buffing Shop.

Annealing shop.

Views in the Dagenham Works.

A large part of the equipment of the works has been done by the company's staff, a joiners' shop being provided; a special type of bench is used in the assembly shops, mounted on cast-iron legs, of which the pattern belongs to the company. The benches are shown in the views on page 589, and it will be seen that the design is very simple and easily constructed, while experience has proved that it is highly efficient.

The shops have been wired with screwed barrel in a very substantial fashion, high-grade insulated wire being used, and metallic-filament lamps at 220 volts, with the exception of one or two shops that are lighted with high-pressure gas.

A manufacture involving the use of such large numbers of parts, many of which are utilised in the construction of quite distinct types of apparatus, could not be carried on with economy and efficiency without the aid of a highly organised system of management, and this we find fully developed at the Dagenham works.

The foundation is, of course, the card-index system, which pervades the whole factory; there is also an elaborate system of shop orders by means of which the exact position of every order can always be immediately ascertained, andevery shop foreman knows precisely what work he has in hand, where he is to send it to when he has done with it, and whence he will receive a further batch. The governing principle in the "progress department" is always to keep one week's work allocated to the various departments, and to keep track of every order throughout its passage through the works. In the drawing office, too, a rigid system of filing and classification prevails. All drawings are made on standard sizes of paper, commencing with 8 in. × 5 in., and proceeding through 8 in. × 10 in., and so on, by regular steps; this greatly aids filing, enabling hundreds of drawings to be filed on edge in a single drawer. In fact, every device is adopted that assists in lessening labour and hastening the arrival at the desired end.

The interests of the employés have not been neglected; in addition to exceptionally well devised sanitary arrangements, a kitchen has been provided, with large mess-rooms, where the workpeople can cook and eat their meals in comfort. This is a particularly important feature in the case of a works situated, as this is, in a neighbourhood where facilities for refreshment are lacking.

Considering that the works were only started 2½ years ago, and that in the interval they have been fully organised, filled with work, and extended, great credit is due to the management of the undertaking for the ceaseless application and unremitting attention to detail without which success would have been impossible. The factory is now in full swing, and the work turned out is of a quality aptly designated by the style of the firm—of "sterling" worth, and British manufacture.

In concluding this brief account of the new works, we take pleasure in congratulating the company on the excellent progress it has made, and in expressing our gratification at the successful establishment of the business as a manufacturing concern, which we trust will enjoy a full share of prosperity.

CONTRACTS CLOSED.

(*Continued from page* 586.)

Bacup.—Messrs. A. Diggle & Son, of Rochdale, have secured the order for motor equipment, &c., at the Corn Mill, Bacup, for Messrs. Ormerod & Co., who are converting part of the premises into a boot and shoe factory.

The T.C. has accepted the tender of the Rawtenstall Corporation for the laying of the cable at Lee Mill and Stacksteads, the cable being supplied by Messrs. W. T. Glover & Co., Ltd.

Birkenhead.—The tender for the six new tramcars for the New Ferry route, which was given to Messrs. Siemens Bros. Dynamo Works, Ltd., at the March meeting of the T.C., was brought up again on April 3rd, when Mr. Willmer declared that the previous vote of the Council was given under a misapprehension. He referred to a letter from Messrs. Milnes, Voss & Co., Ltd., stating that a design for a 60-passenger car 3 ft. 2in. shorter in body than the present New Ferry car, with an approximate weight of 10½ tons, was submitted by the firm. The lowest weight (Mr. Willmer continued) that the Council knew anything about at the last meeting was over 12 tons, and many of them protested against the weight of these cars for that particular route. As an amendment to the motion for the approval of the Tramway Committee minutes, he moved that the matter be referred back, and that the whole question of the weight of the cars to be used on the New Ferry route come before the Council again, the Committee to supply the fullest information. In the subsequent discussion, it was contended that information had been witheld from the Council. The vice-chairman of the Committee explained that the Committee's recommendation was for an 80-passenger car. The price of the 10½-ton car was so much higher relatively than the others that the Committee did not consider it. The amendment was carried by 29 votes to 9.

Blackburn.—The T.C., on April 4th, decided to accept the tender of Messrs. J. W. Garsden & Co. for the supply of telephone and electric bell installations, and that of Messrs. T. Burton and Co. for electric clocks.

The T.C. also accepted the following additional tenders for the supply of goods to the electricity and tramways departments:—

Metallic joint rings, screws, &c.—Messrs. Burrows & Garland.
Packing asbestos.—Messrs. Cresswell's, Ltd.
Presspahn sheets and shellac.—The Birmingham Mica Co.
Waterproof tape.—Messrs. Wm. Geipel & Co.
Siemens's Ozokerit tape, non-hygroscopic tape.—Messrs. Siemens Bros and Co.

Bootle.—The T.C. considered 57 tenders submitted for the supply of machinery and plant for the new electricity works, and accepted the following:—

Boilers.—Babcock & Wilcox, Ltd., £4,598.
Turbo-alternators.—B.T.-H. Co., £6,619.
Condensers, with motors.—Rees Roturbo Co., £1,810.
Three converters.—British Westinghouse Co., £3,090.

The tender of the B.T.-H. Co., Ltd., for switchgear was accepted on condition that it included Messrs. Reyrolle & Co.'s high-tension switchgear.

Devonport.—The T.C. has been recommended by the E.L. Committee to accept the tender of Messrs. Howden & Co., of Glasgow, for a steam turbine, at £5,110.

Glasgow.—The Tramways Committee has recommended the acceptance of the following tenders:—

Brass tubing.—John Stewart & Co., Ltd.
Car bells.—Standard Electric Co., Ltd.
Workshop flexible cable.—W. T. Henley's Telegraph Co., Ltd.
Copper strip.—Charles Henderson & Co., Ltd.
D.C.C. copper wire.—British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.
Scrap for disposal—
(*a*) Copper.—P. & W. MacLellan, Ltd.
(*b*) Lead.—J. D. Anderson & Co.
(*c*) Brass, &c.—Geo. Cunningham.
(*d*) Cable.—Shearer Bros.
(*e*) Zinc.—R. M. Easdale & Co.
Commutators.—Mavor & Coulson, Ltd.

The North British Railway Co. has accepted the tender of the Corona Lampworks, Ltd., for "Corona" 1912 type annealed tungsten wire railway and traction lamps.

Gloucester.—The T.C. has accepted the tender of Messrs. Brown, Bayley's Steel Works for tramcar wheel tires; and that of the Tyne Metal Co., Ltd., for brake blocks.

Kirkcaldy.—Tenders for the supply of the new plant for the electricity works have been reported upon by the manager, and the Committee recommends the Council to accept that of Messrs. Willans & Robinson, at £8,396.

London.—Stepney.—The B.C. has accepted the following tenders for annual supplies:—

Motors.—Siemens Bros. Dynamo Works Co., Ltd., 1 H.P., 790 R.P.M., £13 13s. 2d.; 1½ H.P., 980 R.P.M., £13 13s. 2d.; 2 H.P., 1,210 R.P.M., £13 13s. 2d.; 880 R.P.M., £13 13s. 2d.; 2½ H.P., 1,080 R.P.M., £13 13s. 2d.; 3 H.P., 785 R.P.M., £16 6s. 10d.; 3·4 H.P., 900 R.P.M., £16 6s. 10d.; 4 H.P., 1,060 R.P.M., £16 6s. 10d.; 765 R.P.M., £19 8s. 8d.
Bruce Peebles & Co., Ltd.—5 H.P., 895 R.P.M., £20; 6 H.P., 1,125 R.P.M., £20; 7·5 H.P., 870 R.P.M., £24 15s.; 10 H.P., 790 R.P.M., £49 5s; 15 H.P., 870 R.P.M., £51 2s. 6d.; 20 H.P., 500 R.P.M., £49 10s.; 21 H.P., 800 R.P.M., £40; 27 H.P., 715 R.P.M., £49 10s.; 35 H.P., 675 R.P.M., £58.
Rheostats.—Ferranti, Ltd., 4 H.P., £1 14s. 3d.; 5 H.P., £1 15s. 3d.; 7½ H.P., £1 11s. 3d.; 10 H.P., £1 14s. 3d.; 12½ H.P., £2 16s. 6d.; 15 H.P., £3 3s. 9d.; 20 H.P., £4 2s. 9d.; 25 H.P., £4 14s. 3d.; 30 H.P., £5 18s. 6d.

The contract for the complete installation of lifts for the Institution of Civil Engineers' new buildings, London, has been entrusted to Messrs. Smith, Major & Stevens, Ltd., their standard machine, with vee wheel drive, rendering overwinding impossible, having been selected after investigation of several types. The three main passenger lifts will be fitted with their patent full automatic button system of control.

Bermondsey.—The B.C. has accepted tenders submitted by Messrs. Pirelli, Ltd., for paper cable, lead-covered; by Messrs. W. Geipel & Co. for rubber cable; by the General Electric Co., Ltd., for jointing material, cut-outs, sealing troughs, fuses; by the Dussek Bitumen Co. for jointing material; by Craig, Sharpe, Ltd., for bitumen; by Chamberlain & Hookham, Ltd., for meters, demand indicators and time switches.

Pacific Cable Board.—The *Australian Mining Standard* for March 7th states that the tender of the India-Rubber, Gutta-Percha and Telegraph Works Co. has been accepted by the Pacific Cable Board for the construction and laying of the new cable between Australia and New Zealand. "The starting point on the Australian coast will be in the neighbourhood of Sydney, probably

Bondi, and the terminal point in New Zealand will be Auckland. It is intended also to bring the Norfolk Island cable to Auckland instead of to Doubtless Bay. The work will occupy about ten months."

Salford.—The T.C. has accepted the following tenders for biennial supplies to the Tramways Department:—

Car accessories (electrical) and insulating materials.

Imeson, Finch & Co.	£58	Associated Battery Co.	£84
L. Andrew & Co.	20	Manchester Armature Repair Co.	1,043
B.I. and Helsby Cables, Ltd.	99	Geipel & Co.	358
Micanite and Insulators Co., Ltd.	204	North British Rubber Co.	102
Watlington & Co.	11	C. Mackintosh & Co.	35
General Electric Co.	24	A. Clare & Co.	34
Schultz & Co.	96	British Thomson-Houston Co.	31
Ward & Goldstone	63	Radium Electric Co.	27
W. McGeoch & Co.	60	Gabriel & Co.	23

Car accessories (mechanical).

Imeson, Finch & Co.	£229	W. Boydell & Sons	£793
John Hall	48	National Rail and Tramway Appliances Co.	1,434
Malleable Steel Castings Co.	117	John Baker & Co.	1,895
Phosphor Bronze Co.	465	Radium Electric Co.	27
G. W. Allsopp	76	British Hele-Shaw Patent Clutch Co.	584
Fleming, Birkby & Goodall, Ltd.	684		

Glass.—J. F. Power & Co., £118.

Gravel, sand, pitch, &c.

J. Smith	£390	Lancashire Chemical and Mineral Co.	£1,283
Buxton Lime Firms Co., Ltd.	577	Knowles Oxygen Co.	60
H. Heys & Co., Ltd.	131	A. Warden & Co.	26
J. Statham & Sons	62		

Iron and steel.

J. Kidd & Sons, Ltd.	£285	Vickers, Ltd.	£27

Special car accessories.—Imeson, Finch & Co., schedule of prices.

Special paints and varnishes.

W. Harland & Son	£219	Docker Bros.	£166

The following tenders have also been accepted:—

Alton & Co.—C.I. suction pipes in connection with cooling towers, £88.
B. Thomas.—Main switchboards, &c.—£3,413.

In connection with the electrical undertaking, the following tenders have been accepted for the periods mentioned. Triennial supplies:—

W. Turner (Ardwick), Ltd.—Asphalt bridges, £24.
Beecroft & Wightman, Ltd.—Wood troughing, bends, &c., £1,100.
British Insulated and Helsby Cables, Ltd.—Service fuse boxes, £385.

South Africa.—Among orders recently placed by the South African Railways are the following:—

Electrical wire for delivery at Durban, East London, Port Elizabeth, Cape Town and Braamfontein.—Siemens, Ltd., Johannesburg, £5c9; Telegraph Manufacturing Co., Johannesburg, £658; Henley's (S.A.) Telegraph Works, Johannesburg, £680; Messrs. Sykes & Co., Johannesburg, £23.—*Commercial Intelligence.*

Stretford.—The U.D.C. has accepted the tender of the Electric Construction Co., at £762, for a booster.

Swansea.—The E.L. and Tramways Committee of the T.C. have accepted the tender of the British Thomson-Houston Co., Ltd., for turbo-alternators and condensing plant.

Tunbridge Wells.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for new switchgear, at £857, including £50 for contingencies.

Watford.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works, Ltd., for an annual supply of cable.

West Hartlepool.—The Corporation has again accepted the tender of the Bastian Meter Co., Ltd., for 3 and 5-ampere meters for the year.

Worcester.—The city electrical engineer has been authorised to purchase from the British Thomson-Houston Co 300 A.C. meters.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, April 16th. At 7.30 p.m. At the University, Manchester. Paper on "The Mechanics of Electric Train Movement," by Mr. F. W. Carter.

Illuminating Engineering Society.—Tuesday, April 16th. At 8 p.m. At the Royal Society of Arts. Papers on "The Lighting of Private Houses by Gas and Electricity," by Messrs. W. H. Y. Webber (Gas) and W. R. Rawlings (Electricity).

Junior Institution of Engineers.—Wednesday, April 17th. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "The Lay-out and Erection of Electric Power Plant," by Mr. E. Kilburn Scott.

Institution of Electrical Engineers (Dublin Local Section).—Thursday, April 18th. At 8 p.m. At the New Royal College of Science, Dublin. Paper on "Recent Developments in the Application of Electricity in the Textile Trade," by Mr. F. S. Crowley.

Institution of Electrical Engineers (London).—Thursday, April 18th. At 8 p.m. Adjourned discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes."

Royal Institution.—Thursday, April 18th. At 3 p.m. Lecture on "Synthetic Ammonia and Nitric Acid from the Atmosphere," by Prof. A. W. Crossley.
Friday, April 19th.—At 9 p.m. Discourse on "Electricity Supply: Past, Present and Future," by Mr. A. A. Campbell Swinton.

Association of Engineers-in-Charge.—Saturday, April 20th. Social, Bohemian concert.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued:—

Friday, April 12th.—"D" Company. Recruit training, 7 to 9 p.m. Technical work and lecture on "Military Telephones," 8 to 10 p.m.

Saturday, April 13th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

Monday, April 15th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, April 16th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.

Thursday, April 18th.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, April 19th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m. Recruit instruction, 7 to 10 p.m.

Saturday, April 20th.—Annual course of musketry, at Purfleet. Members are requested to keep open this date in order to attend the above. Railway tickets and information regarding train service will be sent to members notifying their willingness to shoot on this date. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Capt. R.E, and Adjt.,
For Officer commanding L.E.E.

NOTES.

Inquiry.—Mr. L. H. King, electrical engineer to Whitby U.D.C., asks whether any system of electrically-driven pumps for fire extinguishing purposes has been installed in any town in England. By the foregoing is meant an electric motor-driven pump that can be plugged on to suitable standards erected in the streets for that purpose. If any manufacturers have such suitable apparatus, he would be pleased to receive their catalogues.

Appointments Vacant.—Assistant telegraph engineer, for the posts and telegraphs department of the Federated Malay States Government (£300); chief meter inspector and tester for the Greenock Corporation electricity department (42s.); assistant engineer, for the Corporation electricity works, Nuneaton (£110). See our advertisement pages to-day.

Parliamentary.—Clyde Valley Electrical Power Co.—On Tuesday, last week, an inquiry was opened into an application by this company for permission to extend their area of supply. Mr. Wilson, K.C., counsel for promoters, explained that the company had spent something like £600,000, and erected two generating stations—one at Yoker and the other at Motherwell, with about 45,000 H.P. between the two. There were also a large number of sub-stations. The present order had little to do with the Clyde Valley Co. except as regarded the capital of the company. They had issued 60,000 £10 shares, raising £600,000 out of the £900,000, and Clauses 1 to 7 of the present order had been introduced for the purpose of getting power to create real preference shares as regarded both dividend and capital, the rate being 6 per cent. The object of that was to enable the shares to be placed in the market more easily. There was no opposition to that. Mr. Wilson went on to point out that the opposition of the Glasgow Corporation affected only one of the four lighting districts—Shettleston and Tollcross—and the reason they confined themselves to that was that Glasgow were expecting to annex the district under their present Boundaries Bill. They said that in the event of their getting the extension they would be themselves the parties to supply electricity there. The Corporation, Mr. Wilson pointed out, were assuming that they had already got Shettleston and Tollcross, whereas they had not. He contended they should not have a *locus*. He could deprive them of a *locus*, but did not want to do it. As ratepayers the Corporation were covered by the County Council just like all other ratepayers, and they had no *locus* as ratepayers at all. The Corporation were owners of water and gas pipes, and of Tollcross Park, but the company were not touching these at all. In the course of evidence, Mr. McKenzie, chairman of the company, said that this year the company expected to have a profit of £55,000, but people in Shettleston, Bellshill, Uddingston and Bothwell had been pressing them for a supply of electricity. The attitude of Glasgow, however, in their application for Parliamentary powers for extension of their boundaries practically put those districts out of the company's area. Subsequently the Commissioners approved of the preamble.

House of Commons Lighting.—In connection with the proposal to light the House of Commons by electricity, Mr. Lynch asked whether the First Commissioner of Works, in view of the fact that under certain conditions electric light was more fatigueing to the eyes than gaslight, and under other conditions might be preferable, would be guided by expert advice in the installation of any new system in the House of Commons. Mr. Wedgwood Benn replied that the First Commissioner would be happy to obtain the opinion of an oculist upon the question. Replying further to a question by Mr. Ormsby-Gore, Mr. Benn said that if it were the wish of the House that a Select Committee should be appointed to inquire into the best method of lighting the House before any alteration was made, the Chief Commissioner would be glad to accede to it.

Manchester Electro-Harmonic Society.—The first smoking concert in connection with the newly formed Society was held on March 22nd, at the Albion Hotel, Manchester.

The hon. sec., Mr. J. Hill, introduced Mr. S. L. Pearce, the city electrical engineer, to the members as the first president of the Society, who, on rising to address the members, said he was exceedingly gratified to see so many people present—there being over 200. The formation of the Society, he said, was largely due to the great amount of work and time Mr. J. Hill, the hon. sec., had given to it. It was proposed to have four smoking concerts during the session, which would run from October to March, and, in addition, to hold two ladies' evenings. They wanted the membership of the Society to include all who were interested in the electrical industry—Corporation engineers, consulting engineers, manufacturers, wholesale houses and contractors. He was perfectly sure that such gatherings would help to establish good feeling in the electrical engineering industry.

Mr. P. B. Hall (hon. treasurer) stated that the finances of the Society were in a healthy condition.

Mr. C. M. Dorman congratulated the committee on getting Mr. Pearce to become the first president, and said that in Manchester they considered Mr. Pearce as "the Dean of the electrical industry." He proposed a hearty vote of thanks to him for taking the chair, which Mr. J. H. Greaves seconded, and the president was received with musical honours on rising to reply. He said that they had made an excellent start. Some of them did not give as much time to music as they ought to, but in coming there they would make amends.

The whole of the items on the programme were excellently rendered and were received with great appreciation.

Walking Contest. — From various causes only four competitors started in the Hackney and Clapton Walking Clubs' first annual time trial walking race from London to Southend-on-Sea, a total distance of 41¾ miles, which took place on Saturday, April 6th, starting from the Royal Exchange (Mansion House end of Cornhill) and finishing at Southend Pier entrance. A. R. Edwards (late of May-Oatway Fire Appliances, Ltd.), who holds several road walking records, led all the way, and in finishing first in 6 hours 47 minutes 37⅘ seconds was well inside the standard for record. The second man, S. C. Haynes, of Associated Fire Alarms, Ltd., who is only 18 years of age, did a splendid performance, this being his first attempt in a walking race. Result: A. R. Edwards, Hackney W.C., 6 hours 47 minutes 37⅘ seconds, first; S. C. Haynes, Hackney W.C., 8 hours 17 minutes 2⅘ seconds, second; C. T. Osterberg, Hackney W.C., 8 hours 23 minutes 50⅘ seconds, third; W. J. Spayne, Clapton W.C., 10 hours 15 minutes 5⅘ seconds, fourth. The Committee are now considering the promotion of a walking race to be held on Whit Monday, at a distance of about 24 miles, and invite suggestions, which should be sent to Mr. E. H. Roofe, 2, The Oval, Kennington, S.E., or Mr. S. C. Haynes, 20, Penda Road, Clapton Park, N.E.

Another Accumulator Sell?—Some time ago it was reported that a German scientist, residing in Norway, had invented an electric accumulator for high voltage; however, it did not fulfil expectations. But the inventor did not give up the task, and now claims to have succeeded. The cell is described as a little thing, not more than 11 cm. square and 10 cm. high, although it is capable of producing a current of 6 amperes. The pressure, it is stated, has been worked up to 65 volts, and a 16-candle lamp can be kept burning for 24 hours by means of the energy supplied from this little accumulator. The plates used are made of metallic oxide, and are said to be as hard and solid as if they had been made of metal, besides being very durable. They are placed in a pulpy mixture, resembling green soap, the composition of which is kept secret by the inventor. The cell is said to have a capacity of 380 watt-hours, and its weight is 2·8 kg., in which is included the weight of the box, which is 0·7 kg. It can be manufactured at a cost of 16s. 6d. to 22s.

Candidly, we do not believe this report, nor do we ask our readers to put any faith in it. But we should be only too glad if so excellent a performance could be achieved.

Royal Commission on Imperial Trade.—The King has approved of the appointment of members of a Royal Commission to inquire into the natural resources and improvement of trade of the Empire. The United Kingdom will be represented by the following:—Lord Inchcape of Strathnaver; Sir Edgar Vincent; Sir C. J. Owens; Sir H. Rider Haggard; Mr. T. Garnett; and Mr. W. Lorimer. Canada will be represented by the Hon. G. E. Foster, Australia by Mr. Donald Campbell, New Zealand by Sir J. G. Ward, South Africa by the Hon. Sid D. de Villiers Graaf, and New Zealand by the Hon. E. Bowring. Mr. W. A. Robinson, of the Colonial Office, is secretary of the Commission.

Electrical Imports and Exports in March.—The following are the figures appearing in the foreign trade returns for the month of March:—

	March, 1912.	*Increase.*
Imports.—Electrical goods and apparatus	£136,270	£10,269
Machinery	607,967	30,340
Exports.—Electrical goods and apparatus	£2,799,172	£394,060
Machinery	2,799,172	33,733

For the three months electrical goods and apparatus imported show an increase of £9,875, and electrical goods and apparatus exported, a decrease of £95,802.

Institution and Lecture Notes.—Imperial College of Science and Technology.—A special short course of lectures on "Rubber" will be delivered in the Chemistry Lecture Theatre of the Royal College of Science by Dr. Philip Schidrowitz and Mr. H. Wright on Mondays, Wednesdays, and Fridays from 5 to 6 p.m. The first lecture will be given by Mr. Wright on Wednesday, April 24th, and thereafter the lectures will be delivered alternately by Dr. Schidrowitz and Mr. Wright. A synopsis of the course (fee £2) has been published, and communications should be addressed to the secretary.

Institution of Electrical Engineers (Yorkshire Local Section).—Mr. W. T. Wardale, of Sheffield, recently gave a lecture on the relative advantages of electrical and mechanical driving of factories before the Local Section. Comparing various power systems, he gave the cost per B.H.P.-hour (capital costs included) for a 20-B.H.P. load as follows: Town's gas engine, 0·551d. (at 1s. 4d. per 1,000 cb. ft. for gas); Diesel engine, 0·558d. (at £2 per ton for oil); suction-gas engine, 0·584d. (at £1 per ton for anthracite peas); as against an electric motor, 0·6d. (at 0·7d. per unit.

The Institution of Electrical Engineers (Students' Section).—The honorary secretary (Mr. J. B. Sparks, 27, Mowbray Road, Brondesbury, N.W.), will be pleased to receive nominations for extra-collegiate members of the Committee for the session 1912-13. Nominations should be sent in before Tuesday next.

Institution of Electrical Engineers (Scottish Local Section).—The meeting announced for April 9th was postponed to April 11th. Unfortunately the notice reached us too late for insertion in our last issue.

Society of Engineers (Incorporated).—A paper on ligno-concrete was read by Mr. Gerald O. Case on April 1st. The author referred to the use in America and Australia of concrete in combination with timber, and pointed out that while the concrete effectually preserves the timber, for the same ultimate strength of beam, it is necessary to use 9 per cent. of sectional area of pitch-pine tensile reinforcements, as against 1 per cent. steel reinforcements. A comparison of the prices of steel and pitch-pine shows a saving in favour of ligno-concrete. Where more than about 1·2 per cent. of steel reinforcement is required, ligno-concrete cannot compete with ferro-concrete, because the timber bars would be too large for convenient use.

Copper.—During the past month, we find from Messrs. Merton's statistical circular, the visible supplies of copper (European) have decreased only 1,332 tons. This might be attributed to the low demand, consequent upon the general feeling of instability prevailing, but, with deliveries at 40,756 tons, this can hardly have been so deeply affected as other metals. The diminution generally has been in stocks at Liverpool and Swansea, with 450 tons less afloat from Chile and Australia. Copper has been transferred from both Rotterdam and Hamburg, the former being less by 300 tons, and the latter by the same quantity. Detailed supplies show North American average, Spain and Portugal very low, Chile little more than half average, but Australia just over average. Stock in American producers' hands, as published by their Association, shows 1,491 less, but this is showing a decrease, standing only at 28,098 tons for the end of February (last figures published). The world's supply stands at 79,605 tons for the same date. The restriction of output in the States cannot be otherwise than beneficial to the majority of those engaged in the industry, and shows what can be effected by the intelligent administration of an energetic industrial class.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements*

Central Station Officials.—Mr. W. L. D. Gundry, late mains engineer, has been presented with a handsome Gladstone bag by the staff of the Plymouth Corporation electricity works on his leaving the Corporation, to join, as a director, Messrs. Lord and Shand, Ltd., electrical engineers, of Plymouth, Launceston, Newquay, and Penzance.

Mr. F. B. Sims, of the Grantham staff of the Urban Electric Supply Co., who is leaving to take up a position under the company at Stamford, has been presented by his colleagues with a silver-mounted walking stick, fountain pen, and pocket book.

Mr. H. P. Stokes, borough electrical engineer, Ilkeston, has been requested by the County Council to prepare specifications for the lighting of the new secondary schools, about to be erected at Ilkeston, and also to superintend the work on the usual terms as to commission. The T.C. has also given Mr. Stokes control of all the electrical and mechanical apparatus in use in the various departments of the Corporation, and in addition to this, he is to take charge of the plant now being installed at the new sewage disposal works.

Mr. J. G. Bruce, chief electrical engineer of the Willesden District Council, who is leaving shortly for Buenos Ayres, was on Wednesday last the recipient of a recording barometer presented by the members of the staff, the chairman of the Electricity Committee, Mr. H. Davey Turner, making the presentation.

The Nelson T.C., on April 4th, decided that the salary of Mr. D Helme, electrical engineer and tramways manager, be increased from £250 to £275 per annum. Small increases were sanctioned in the following cases: Mr. W. M. Thomson, senior charge engineer; Mr. A. Colbenson, shift engineer; Mr. W. G. Coates, shift engineer; and Mr. W. D. Chalmers, outside assistant.

Mr. F. Ffrench, of Kidderminster, has been appointed mains assistant to the Bridlington Corporation Electricity Department.

On 3rd inst., Mr. F. R. Wilkinson, electrical assistant at Lancaster, was the recipient of a silver-mounted walking stick and tobacco pouch from the staff and employés of the electricity works. The presentation was made by Mr. G. C. Milnes, borough electrical and tramways engineer, who expressed the regret which all felt at Mr. Wilkinson's departure.

Tramway Officials.—At Burnley Town Council meeting on April 4th, Alderman Grey moved that a minute recommending an increase of from £400 to £450 per year in the salary of Mr. Mozley, tramway manager, be referred back. In doing so, Alderman Grey said when they advanced wages they ought to know the reason why. Mr. H. Lees seconded, pointing out that in some towns one person performed the dual office of tramway manager and electrical engineer. In Burnley they paid a separate £400 a year to an electrical engineer. Mr. Heap, chairman of the Tramways Committee, said the tramways receipts had increased considerably under Mr. Mozley's management. When Mr. Mozley was appointed the receipts were £8,300. Last year they were £22,454. The amendment was defeated, as was also a further amendment by Mr. Lees, that the increase be £20.

Mr. S. Woodfield has accepted the position of chief engineer to the Buenos Ayres Lacroze Tramways Co. and the Buenos Ayres Central Railway, and will shortly leave for Buenos Ayres.

General.—Mr. John H. Bunting, of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, is about to leave this country for an extended tour in South America, on behalf of his firm. He sails from Southampton on 12th inst. on the s.s. *Aragon*, for Rio de Janeiro, and in addition will also visit Buenos Ayres, Valparaiso, and other important cities. He expects to be away for about four months, and his many friends at home and abroad, will wish him a safe and prosperous journey.

Messrs. Lacey & Sillar, consulting engineers, have dissolved partnership. Mr. A. M. Sillar will continue practice at 40, Broadway, Westminster, S.W., and Mr. E. M. Lacey remains at Iddesleigh Mansions, Caxton Street, Westminster, S.W.

Mr. Albert H. Stanley, managing director of the Underground Electric Railways Co., of London, has been appointed a director of the London General Omnibus Co.

Mr. T. Stevens, is resigning his position as engineer to the London office of the B.T.-H. Co. His first work will be in connection with the water-power developments and electric railway now in progress under the consulting engineers, Messrs. McCarter and Kerr Bock, Donington House, W.C., for the Compania Hidro Electrica de Tucuman, in Argentine Republic. Mr. Stevens leaves London to-day, 12th inst., for Buenos Ayres, and he will be in Argentina about two or three months.

Obituary.—Mr. Robinson Souttar.—In its obituary of Mr. Robinson Souttar, who died last week at the age of 64 years, the *Times* says that in his early years Mr. Souttar came to London to the office of Mr. George Hopkins, a well-known Parliamentary engineer, under whom he was employed in superintending the building of the North Metropolitan, Dublin, and Liverpool tramways. Eventually Mr. Souttar took a contract in Calcutta with Messrs. G. A. Parrish, and lived there for five years, building 40 miles of tramways.

NEW COMPANIES REGISTERED.

Electric Blasting Apparatus Co., Ltd. (120,963).—This company was registered on March 20th, with a capital of £20,000 in £10 shares, to carry on the business of manufacturers of and dealers in electric detonator fuses (with or without detonators), insulated wires and cables, batteries, exploders and other appliances, &c., and to carry into effect a contract with F. W. T. Brain. The subscribers (with one share each) are:—E. S. Harper, 24, King Edward's Terrace, All Souls Avenue, Willesden, N.W., clerk; J. A. Fuller, 110, Birdar Road, Wood Green, N., clerk. Private company. The management is vested in a "committee of management" of less than two or more than seven members. The subscribers are to appoint the first. Remuneration as fixed by the company. Registered office, Cinderford, Glos.

B. & S. Massey, Ltd. (121,004).—This company was registered on March 22nd, with a capital of £110,000 in £1 shares, to take over the business of steam and power hammer manufacturers and engineers, carried on by S. Massey, L. F. Massey, and H. F. Massey, at Openshaw, Manchester, as B. & S. Massey, and to carry on the same and the business of mechanical, electrical, and hydraulic engineers, electricians, &c. The subscribers (with one share each) are:—L. F. Massey, Steam Hammer Works, Openshaw, Manchester, engineer; H. F. Massey, Steam Hammer Works, Openshaw, Manchester, engineer. Private company. The number of directors is not to be less than two or more than five; the first are L. F. Massey and H. F. Massey; qualification, £500; remuneration (except managing director) as fixed by the company. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Perak Hydro-Electric Power Syndicate, Ltd. (121,146).—This company was registered on March 28th, with a capital of £10,000 in £1 shares, to carry on in the Federated Malay States and the Straits Settlements the business of an electric light and power company in all its branches, and to adopt an agreement with F. D. Osborne. The subscribers (with one share each) are:—C. A. Peyton, 55, Lavington Road, Ealing, W., clerk; J. Gray, 65, London Wall, E.C., secretary to public company; E. C. Brown, 20, Station Parade, Enfield, N., clerk; A. Knight, 79, Langthorne Street, Fulham, S.W., clerk; E. M. Coleman, 29, Elm Road, Wembley, N.W., typist; S. W. Tunbridge, 33, Moring Road, Tooting, S.W., clerk; A. W. Shearman, 61, Canton Street, Poplar, E., clerk. Minimum cash subscription seven shares. The number of directors is not to be less than two or more than six; the first are F. D. Osborne, C. V. Thomas, and W. A. Luning (all permanent); qualification, £250; remuneration (except managing director), 10 per cent. of the net profits in each year. Registered office, 65, London Wall, E.C.

W. R. Reynolds, Ltd. (121,153).—This company was registered on March 28th, with a capital of £250 in £1 shares, to carry on the business of electrical engineers, manufacturers of electrical engines, machines and fittings, &c. The subscribers (with one share each) are:—W. R. Reynolds, 312, Barking Road, East Ham, electrician; R. Levin, 65A, Cranbrook Road, Ilford, cabinet maker. Private company. The number of directors is not to be less than two or more than five; the first are not named. Registered by Roberts & Co., 87 and 88, Aldgate, E.C.

Anglo-Argentine General Electric Co., Ltd. (121,204).—Registered April 1st, by F. Samuelson, 71a, Queen Victoria Street, E.C. Capital, £65,000 in 63,000 preference shares of £1 each and 40,000 ordinary shares of 1s. each. Objects: to carry on in South America or elsewhere the business of electricians, electrical and mechanical engineers, suppliers of electricity, &c., and to adopt an agreement with the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., and Colson, Brookhouse & Pyne, of Buenos Ayres. The signatories (with 100 preference shares each) are:—H. Hirst, 67, Queen Victoria Street, E.C., electrical engineer; T. Colson, Dawson Place Mansions, Bayswater, W., merchant. Private company. The first directors (to number not less than two or more than six) are H. Hirst (appointed by the General Electric Co., Ltd.) and T. Colson (appointed by Colson, Brookhouse and Pyne); qualification, 250 preference shares; remuneration as fixed by the company. Registered office, 67, Queen Victoria Street, E.C.

Electric Appliances Co., Ltd. (121,215).—This company was registered on April 1st, with a capital of £8,000 in 4,000 preference shares of £1 each and 16,000 ordinary shares of 5s. each, to carry on the business of manufacturers of, and dealers in, vacuum cleaners, vibrators, electro-medical appliances, dry batteries and electric supplies and accessories, &c. The subscribers (with one share each) are:—E. C. Harkness, 31, Rusthall Avenue, Bedford Park, W., merchant; W. F. Harkness, 31, Rusthall Avenue, Bedford Park, W., merchant. Private company. The number of directors is not to be less than two or more than five; the first are E. C. Harkness (managing director), W. F. Harkness and J. G. McDougall. Registered office, 28, Rosebery Avenue, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Carlsbad Electro-Thermal Baths, Ltd. (114,257).—Particulars of £500 debentures, created by resolutions of December 1st, 1911, and March 13th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, appliances, patents, &c. No trustees.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Issue on March 30th, 1912, of £30,000 debentures, part of a series of which particulars have already been filed.

Central Electric Supply Co., Ltd. (53,080).—Return dated February 14th, filed February 19th, 1912. Capital £100,000 in £5 shares. All shares taken up. £5 per share called up. £100,000 paid. Mortgages and charges: £450,000 4 per cent. guaranteed debenture stock.

Bright's Light and Power, Ltd. (58,290).—Return dated December 31st, 1911, filed March 7th, 1912. Capital £200,000 in £1 shares (100,000 preference). 100,000 ordinary shares taken up. £1 per share called up on 66,667 shares. £66,489 5s. paid, leaving £177 15s. in arrears. £33,333 considered as paid on 33,333 shares. Mortgages and charges: £16,000.

Aron Electricity Meter, Ltd. (58,650).—A memorandum of satisfaction in full of mortgages created by trust deed dated July 11th, 1901, and supplemental deed dated February 20th, 1902, securing £75,000, has been filed.

Chichester Electric Light and Power Co., Ltd. (86,998).—Mortgage dated March 29th, 1912, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital, and sinking fund policy for £10,000. Holders: Caledonian Insurance Co., Edinburgh.

Rugby Lamp Co., Ltd.—Particulars of £7,500 debentures, created December 30th, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £4,700. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Reading Electric Supply Co., Ltd.—Particulars of £50,000 debentures, created February 23rd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £15,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd.—Issue on March 8th, 1912, of £8,200 debentures, part of a series of which particulars have already been filed.

Bude Electric Supply Co., Ltd.—The total receipts on revenue account for 1911 were £1,821 and the working expenses £616, leaving a gross profit of £1,205. After deducting interest on debentures and temporary loans, there remains a net profit of £1,065, with £78 brought forward, making a total of £1,143 available for disposal. This, according to a financial paper, the directors recommend should be allocated as follows: To 7 per cent. dividend and commission to secretary, £632; £400 to depreciation account, increasing it to £860, carrying forward £111.

Carlisle Electric Tramways Co., Ltd.—The directors report that for 1911, after providing for debenture interest, there is a surplus of £64 to be carried forward.

CITY NOTES.

North Metropolitan Electric Power Supply Co.

The annual meeting was held at the offices of the Electrical Federation, Kingsway, W.C., on April 3rd, Mr. E. Garcke presiding.

The Chairman, in moving the adoption of the report, said that during the 12 months the revenue had been £132,875, compared with £112,731 in 1910, an increase of £20,144, which was equivalent to 17·6 per cent. The company sold 26,454,492 units of electricity, being an increase of over 5,000,000 units, and equivalent to 25·5 per cent. They commenced supplying in Southgate in April, 1911, and a supply for public lighting and private purposes had also been commenced in the district of Edgware. The supply to the latter place was particularly interesting, because it was not under an electric lighting order, but was under the rather special powers contained in the company's Act of Parliament, of 1907, which enabled them to supply for lighting purposes throughout most of their extensive limits, subject to certain consents. Moreover, this supply in Edgware justified in the public interests the granting of such powers, because there was no doubt whatever that were it not for such a company as theirs, districts like Edgware and the adjoining district of Kingsbury, would be compelled to wait many years before the advantages of electricity could be obtained by means of public supply. Arrangements were now proceeding to supply in accordance with the same powers in the district of Hadley, near Barnet, and subsequently this supply would be extended to East Barnet Valley. The electricity supply business of the company had increased very largely of recent years. Either directly or indirectly the company was responsible for the supply of electricity in no fewer than 12 separate districts throughout the North Metropolitan area, viz., Willesden, Hendon, Stoke Newington, Barnet, Enfield, Hertford, St. Albans, Southgate, Edmonton, Tottenham, Kingsbury and Edgware. The supply had, during the year, been maintained without interruption. Happily, they were able to maintain the supply until such time as they were able to replenish their coal stocks. A feature of serious moment was the fact that not only the price of coal had risen, but the prices of other commodities were rising, and the cost of production would undoubtedly increase abnormally during the present year. It would be a matter for serious consideration by the directors whether some increase in the electricity rates should not be made, but so far no decision had been come to. The expenditure last year increased by £10,374, equivalent to 18·6 per cent. That percentage of increase was just slightly higher than the increase in the revenue and was due to the operation of their new undertakings, where, in the early days, the costs were comparatively heavy. The balance to revenue account had increased from £62,425 to £72,694—an improvement of £9,769, or equivalent to 15·6 per cent. There was a net balance of £66,726 available for appropriation. Included in the item of £5,152 on the credit side of the net revenue account was the dividend of 5 per cent. which they had received in respect of the past year on their investment in the North Metropolitan Electrical Power Distribution Co., whose distribution in Barnet, Enfield, Hertford and St. Albans continued to extend satisfactorily. The capital expenditure last year amounted to £42,164, of which £26,146 was upon mains. Extensions had become necessary at three of their four generating stations in order to deal with the load, which was always tending to increase, and at St. Albans additional plant had already been installed. Two 3,000-kw. turbines were now on order for delivery, one to Brimsdown, and one to Willesden. To meet this expenditure it would be necessary to issue a further £100,000 6 per cent. cumulative preference stock at an early date. He congratulated the shareholders on a successful year, and trusted that, notwithstanding the serious anxieties to which he had referred in connection with the strike, and the rise in prices, the current year would show good results.

Sir Ernest Spencer seconded the motion, and the report was carried unanimously.

Official Announcements re Companies.—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved :—

City and Surrey Electric Railway Co., Ltd.
Cooke's Patent Tramway System, Ltd.
Electrical Manufacturers' and Wholesale Traders' Protection Association, Ltd.
Electrical Circuit Breaker, Ltd.
Furnace and Boiler Syndicate, Ltd.
Galvano Chemical Co., Ltd.
Garrett Automatic Sprinkler, Ltd.
Gaseous Steam Generator, Ltd.
Hughes Metallic Packing Co., Ltd.
Lowden Electric Lamp Co., Ltd.
Maybaum Adding Machine Co., Ltd.
Mechanical and Electrical Power Co., Ltd.
Munro Fire Detector Co., Ltd.
Phœnix Peat Fuel Syndicate, Ltd.
Soler Aluminium French Works Syndicate, Ltd.
Soler Aluminium Parent Syndicate, Ltd.
Sperling's Lock Nut (Foreign), Ltd.

Reading Electric Supply Co., Ltd.—The report states (says the *Financier*) that the accounts for 1911 show an available sum, including £524 brought forward, of £5,657. A dividend of 3½ per cent. has been declared, and £420 is carried forward.

Mexico Tramways Co.—The directors have declared a dividend of 1½ per cent. for the quarter to March 31st.

Folkestone Electricity Supply Co., Ltd.

At the annual meeting, the Chairman (Alderman Spurgen), in moving the adoption of the report (see Electrical Review, page 514), said that at the previous meeting he told them that the whole of the remainder of the debenture stock had been issued in one lot, and the borrowing powers of the company were then exhausted. The capital stood at £200,000, but they had spent £13,000 beyond that, taking into account the sums placed to reserve and to depreciation account. Last year their expenditure on capital account had been £6,896, compared with £3,190 in the previous year, as they had put in a new set of engines supplied by the Brush Co. Their total revenue had been £25,142, against £23,933 in 1910, an increase of £9,208. In ordinary sales to their customers there was an increase of £1,049, which showed very satisfactory progress, considering that there had been so little building going on. The expenditure on revenue account showed an increase of £698. Coal had cost them more, and they had been obliged to consume more. The profit for the year showed an increase of £858. They had maintained their plant out of revenue, and placed £6,058 to depreciation account. They had at the present time 3,077 consumers, an increase of 146 during the year. Thirteen years ago they had only 176 consumers. The company had not been much affected by the coal strike, and had enough coal in hand to last them until the middle of May, by which time they hoped they would be able to get new stock on fairly reasonable terms, although he anticipated there would be an increase in the price. People might say that a shilling a ton at the pit's mouth would not make much difference to them, but everyone had to get a profit on that shilling, and by the time it got to them it had got to half-a-crown. He looked forward to an increased use of electricity, as they were now competing with the gas companies in the supply of power for cooking and heating purposes, and he felt there was a large opening for electricity companies in that direction. The directors recommended a dividend of 6 per cent. on the ordinary share capital.

Colonel Penfold seconded the motion, which was carried.

In replying to a vote of thanks, Alderman Spurgen paid a tribute to the memory of the late Mr. C. J. Pursey, a director, who had been one of the foremost advocates of the introduction of electrical works into Folkestone, and had been associated with the company from its inception until his death.

Great Northern Telegraph Co., Ltd., of Denmark.—The traffic receipts for the year 1911 have, as foreseen, decreased considerably owing to the loss of the company's Norwegian concessions, the sale of the Corean cable, and the tariff reductions made during the year. The decrease has, however, been partly counterbalanced by the increase of the Government and Press correspondence caused by the extraordinary events which the year 1911 has witnessed, especially the revolution in China. On the other hand, the increase of staff required to cope with the increased work, together with all the measures which became necessary in order to secure the maintenance of the telegraphic communications in China and the safety of the company's Danish and native staff, have necessitated considerable extra expenditure. As a matter of fact, the net receipts for the year have decreased by about £24,000 compared with the year 1910, but as this amount is not larger than was expected, and a larger balance than usual was carried forward to 1911, the board of directors announce that they do not hesitate to propose the distribution of a total dividend and bonus of 18 per cent., including the 5 per cent. already paid, and to transfer to the reserve and pension funds the usual amounts of £55,556 and £11,111 respectively. The general meeting will be held at Copenhagen on April 29th.

Mirrlees-Watson Co., Ltd.—The annual meeting of this company was held in the company's offices, Glasgow, on March 15th. The profit and loss account showed that the profit available for distribution, after bringing forward from the previous year the sum of £1,996, and providing amply for depreciation and business contingencies, was £50,135. The directors recommended, and the meeting approved of, a dividend of 10 per cent. and a bonus of 5 per cent., both less income-tax, that £30,000 be added to the general reserve account, and £2,479 be carried forward. Last year the company paid similar dividend and bonus.

Indian Electric Supply and Traction Co., Ltd.—The directors report that the surplus on the year's working to December 31st in Cawnpore, including £282 for interest accrued, was £7,907, against £4,935 in 1910, and including further interest accrued in England, £119, and transfer fees, £1 10s., the credit side of the revenue account shows a total of £8,027 ; London expenditure was £640, and after providing for debenture interest, £2,700, there remains a net profit of £4,687. This amount, says the *Financier*, has reduced the balance at the debit of profit and loss to £11,852. The first mortgage debentures fall due for payment on December 31st next, and this will necessitate some reorganisation of the company's finances. The directors are giving the matter their careful consideration.

Lancashire Power Construction Co.—This company's revenue is derived entirely from the Lancashire Electric Power Co., of which it is the sole owner, and the trading profit of that company for the year 1911 (according to the *Financial News*) amounted to £10,695. The amount standing to the debit of the revenue account, after payment of debenture interest, &c., is £7,737.

Anglo-Argentine Tramways Co., Ltd.

The directors report that the results of the working for the year 1911 were as follows: Gross receipts, £2,631,836; less working expenses (which include various items amounting in the aggregate to £120,000 carried to depreciation renewals funds, in addition to £298,012 expended on ordinary maintenance), £1,723,929; leaving £907,907, plus £13,045 brought forward, making £920,952, less interest and charges as per net revenue account, £727,557, leaving £193,395, less interim dividend of 4 per cent., less income-tax, on ordinary shares for half-year ending June 30th, 1911, £94,167 = £99,228. Out of this the directors now recommend that a final dividend of 3½ per cent. be paid on the ordinary shares for the half-year ending December 31st, 1911, less income-tax, making 7½ per cent. for the year, which will absorb £88,281, leaving £10,947 to be carried forward. The inauguration of the excavation work on the first subway took place on September 14th, 1911. The ceremony of turning the first sod was performed Dr. Gomez, Minister of the Interior, representing the President of the Republic. The work is being pushed forward with all possible speed, and it is expected that the first subway—Plaza Mayo to Plaza Once will be opened by June, 1913. Active operations upon the second subway will be commenced at an early date.

In order to provide funds towards the cost of subways construction and properties required in connection therewith, new extensions and additional rolling stock, a further issue of £1,500,000 5 per cent. debenture stock was made in October last at the price of 97½ per cent. Mr. T. Frame Thomson, a former director, has rejoined the board, and has been elected deputy-chairman. The directors record their appreciation of the services rendered by the local committee, the general manager (Mr. Pedriali), and the staff generally, both in Buenos Ayres and at home.

The directors publish lengthy extracts from the report of the general manager, in which he deals with the state of commerce and with building trade activity in Buenos Ayres, and, later, says that the number of passengers carried shows a good increase, in spite of the fact that comparisons are made with the centenary year. The following are the figures:—Passengers carried:—1910, 276,426,524; 1911, 299,154,835; inc. 8·22 per cent. Car kilometres run:—1910, 69,001,773; 1911, 73,550,888; inc., 6·59 per cent. The company's rolling stock at December 31st, 1910, amounted to 1,469 motors and 697 trailers, and at the end of year under review to 1,541 motors and 666 trailers. The following is a summary of the most important works carried out during the year:—

Totally re-constructed	Motors 13	Trailers 21
Revised and partially re-constructed ..	Motors 27	Trailers 2
Re-painted	Motors 186	Trailers 64
Partially re-painted and re-varnished	Motors 244	Trailers 298

The overhead installation has worked very satisfactorily, the breakages of trolley wire being comparatively few and unimportant in their consequences. As regards the underground feeder system, a very serious accident occurred to the cables of the Bustamante sub-station, which were all completely burnt out as a result of a short-circuit caused by electrolysis. In consequence of this accident the services in the Flores section were partially interrupted during three days. Measures have now been taken for minimising the possibilities of an accident of a similar nature occurring again. Many underground feeder cables of the incorporated companies have been replaced in certain districts by new cables of larger diameter, the old ones existing not being sufficient to carry the high tensions required for the heavy services.

Considerable work has been done on the removal of one of the two existing telephone protection wires in many streets, especially at curves, crossings and at other strategical points where the complicated netting of overhead wires puts the whole overheading installation in imminent danger of being torn down whenever the trolley pole happened to derail. This suppression of telephone protection wires has considerably reduced the number of breakages of trolley wire. The standard trolley wire now used on the surface lines has a section of 80 mm². Whenever it becomes necessary to renew old trolley wire, it is replaced by wire of the standard type.

The permanent way work undertaken has continued to be very heavy, due principally to the reconstruction by the municipality of pavement on a definite level in an abnormal number of streets, which has necessitated completely reconstructing the tracks in the streets affected by these paving works. The number of squares where the company was obliged to reconstruct its tracks as a consequence of the above-mentioned works amounted at end of December to 151 squares, or, say, 15 kilometres more or less.

The new extensions constructed during the year amounted at December 31st to 57 squares of double and 4 of single track, or, say, roughly 7 kilometres of double track. A very considerable amount of works has also been done for the subway construction office.

The average current consumption per car-kilometre has increased slightly. This increase is principally due to the great congestion of street traffic in the city, as also to the extraordinary amount of paving works carried out, which adversely affects the consumption.

The year 1911 was one of exceptionally bad weather. A dry, hot summer, followed by severe rain storms and by an exceptionally severe winter, adversely affected the traffic. The increase in gross receipts over 1910, however, amounted to £209,492, about 8·75 per cent. more than was anticipated a year ago. The receipts in 1910 increased over 1909 by almost 14 per cent., part of which increase was due to the centenary traffic. The increased receipts over 1909 amounted to over half a million sterling, nearly 24 per cent. more in the two years. Expenditure in 1911, apart from normal increases due to heavier traffic, had had to bear some exceptionally heavy charges from temporary or unavoidable circumstances. An expense which would not recur was the bonus to guards, motormen and workmen for the last quarter of 1910 paid during 1911, £12,356. The rise in the price of coal had cost an extra £22,563 for energy. An item of expenditure which reappeared in the accounts was the 12 per cent. additional municipal tax, in respect of which $240,000 had been paid. When the gross receipts amount to more than $50,000 per km. of line in service, the municipal tax of 6 per cent. upon the gross receipts is increased by 12 per cent. in respect of the excess over the above rate per kilometre. The above special items of expenditure amounted together to about £56,000, or rather over 2 per cent. on the gross receipts. The percentage of expenditure on receipts increased from 59·10 per cent. to 60·41 per cent. owing to the three particular causes already mentioned.

A petition was presented to the Mayor for leave to construct some 30 km. of new tracks. This petition has been favourably reported upon by the Departments concerned, and now awaits the drawing up of the necessary *ad referendum* agreement.

	1909.*	1910.†	1911.†
Receipts	£1,938,888	£2,419,186	£2,631,836
Expenditure	1,207,222	1,564,093	1,723,928
Passengers carried ..	223,823,792	276,426,524	299,154,835
Miles run	35,180,089	42,881,895	46,019,328
Receipts per mile run..	13 25d.	13·54d.	13·73d.
Expenses per mile run	7·90d.‡	8·14d.‡	8·36d.‡
Cars in stock	2,080	2,156	2,207

* Includes La Capital, Buenos Ayres Grand National, La Nueva and Metropolitano systems for the last nine months of the year. † Full year's working of incorporated companies. ‡ Does not include credits or debits to depreciation renewal funds.

Alderley and Wilmslow Electric Supply, Ltd.

The directors' report for the year ended December 31st, 1911, says that the total lamp connections have increased from an equivalent of 21,377 to 22,866 8-c.p. lamps. The result of the year's working shows a profit of £2,252, which, with £129 brought forward, gives a total of £2,381, and after paying £1,547, interest on debentures and loans, there remains a balance of £834, of which the directors recommend that £650 should be put to reserve fund, and the balance, £184, carried forward.

Units generated	234,708
Units sold—Public lamps	31,007
Private consumers by meter	146,464
Total sold	177,471
Used on works	50,289
Total quantity accounted for	227,760
Quantity not accounted for..	6,948
Number of public lamps	257
Total maximum supply demanded, kw..	149
Lamps connected January 1st	21,377
Lamps connected December 31st..	22,866

Babcock & Wilcox, Ltd.—The board have declared a final dividend for 1911 of 8 per cent., together with a bonus of 8 per cent., making a total distribution for the year of 28 per cent., as compared with 26 per cent. for 1910. In the preceding 12 months the distribution amounted to 26 per cent. According to a financial paper, the directors state that, having regard to the fact that the extension of the business has required the reserve fund to be employed as working capital, they have under consideration a proposal that an amount equal to the existing ordinary capital of the company be taken from the reserve fund, and added to the capital account.

Guildford Electric Supply Co., Ltd.—The annual meeting was held on March 27th. Mr. H. P. Smallpiece, in moving the adoption of the report, said that the gross receipts for 1911 were £8,679, or £794 better than in 1910, the largest increase for eight years, but the total expenses were, unfortunately, £935 more than in 1910, thus more than wiping out the increase. The chief item of increase was £358 in respect of coal and other fuel, due to the installation of a new large oil engine. On account of complaints made by neighbours as to the vibration caused by the working of the engine, it had, consequently, practically been in use hardly at all during the past year, and the company had had to generate by steam plant instead, which had necessitated an increased outlay on coal and fuel. The difficulty had been overcome, and the oil engine had for some weeks past been in constant use. The capital expenditure had been £2,616, as against £4,593 in the previous year. The prospects for the current year were very promising, and he had good grounds for hoping that in a year's time he would be able to congratulate them on a record year's business. The report was adopted, and the dividend resolution (5 per cent. on the ordinary and 6 per cent. on the preference) was carried.

Hart Accumulator Co., Ltd.—The directors' report to December 31st, 1911, states that the profit for the year was £16,089, plus the balance brought forward £7,162, making a total of £23,250 to be dealt with. After deducting the dividend on preference shares, £423, and transferring £7,500 to reserve account, the balance standing to the credit of profit and loss account was £15,327. The directors recommended that a dividend of 10 per cent. per annum, and a bonus of 2½ per cent. per annum, both free of income-tax, be paid on the ordinary share capital, absorbing £8,297, leaving £7,030 to be carried forward. During the past year the directors paid off the remaining £4,000 of the mortgage to complete the purchase of freeholds. The buildings, plant, tools, &c., had been augmented by £972, which had been charged to capital, and due depreciation on same had been made. The maintenance of the works, plant, &c., had been well kept up at a cost of £1,620, paid for out of revenue. The annual meeting was held on March 13th, at Stratford, E.

Anglo-American Telegraph Co., Ltd.—The directors have resolved to declare an interim dividend for the quarter ending March 31st, 1912, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock less income-tax payable May 1st. The dividend of 1½ per cent. to the "A" shareholders is not payable before the end of the year.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months to March 31st.

Cork Electric Tramways and Lighting Co., Ltd.

The directors' report for the year 1911 states that the result of working is as follows:—Receipts £57,180, expenses £33,327 = £23,853; plus £1,319 brought forward, making £25,172; less interest on debentures £4,600, leaving a balance of £20,572. Of this amount, £6,163 was paid on July 1st and January 1st for the half-yearly dividends on the 5 per cent. cumulative preference shares, £6,500 was added to reserve for depreciation, £1,753 written off, as per revenue account, and the directors recommend that the balance be disposed of as follows:—4 per cent. dividend on the ordinary shares £4,600, carrying to revenue new account £1,555. The lighting and power business again shows satisfactory progress. Agreements for 208 connections were concluded during the past year for an equivalent of 20,246 8-c.p. lamps; this compares with 168 connections and 11,786 8-c.p. lamps for 1910. The additional lighting and power connections represent a total gain of 462 kw., as against 300 kw. in 1910. The total lighting and power receipts are £1,086 in excess of the previous year and the traffic receipts also show an increase of £594. The gross profit for the year is £913 in excess of the previous year. £1,753 has been written off as per revenue account, and £6,500 transferred to reserve for depreciation, as compared with £1,771 and £5,000 respectively for the previous year. The capital expenditure during the year has been mainly expended on additional plant in the power station, house services, and cables. About £9,000 have been invested in first-class securities. No shares or debentures have been issued during the year. The meeting is called for April 25th.

	1909.	1910.	1911.
Traction—			
Miles open	9·89	9·89	9·89
Passengers carried	5,349,041	5,774,071	5,866,523
Average fare	1·05d.	1·07d.	1·07d.
Car mileage	864,228	899,173	891,417
Number of cars	35	35	35
Lighting and Power—			
Number of customers	2,013	2,181	2,389
8-c.p. lamps (equiv.) applied for	134,946	146,792	166,978
8-c.p. lamps (equiv.) connected	129,186	139,493	155,593

Metropolitan Electric Tramways, Ltd.

Mr. Emile Garcke (chairman) presided over the annual general meeting of the above company held on April 3rd at the Electrical Federation Offices, Kingsway.

In moving the adoption of the report (see Electrical Review, page 514), the Chairman said that the year had been marked by expansion in both branches of their business. With regard to the tramways and light railways, in February they opened for traffic the remaining piece of tramway authorised by their Middlesex Light Railway Order, which would join up Enfield with Ponder's End; and this completed the system of 56¾ miles. Apart from this the route-mileage was the same as in 1910, but their traffic receipts showed an increase of £66,674, while the number of passengers carried was, in round figures, 90,000,000, as compared with 76,500,000 for 1910. Their working expenditure was large and showed an increase of £42,746, but their receipts had expanded at a greater rate. The average profit per route-mile was £2,700, compared with £2,400 in the preceding year. This increase indicated the development of traffic in the outlying districts on the more recently opened lines; the £2,700 per route-mile was arrived at after including in the working charges the amount set aside as a reserve for future reconstruction and renewals. They were setting aside £27,170, against £21,900 for the preceding year. This reserve fund was in addition to the £47,700 which they actually expended during the year on repairs and maintenance of their tramways and light railways. The electric supply business carried on by a separate company, in which they held practically all the issued ordinary share capital had given them a better return. For 1911 they received a 6 per cent. dividend, besides a considerable bonus. The total received was £31,500, against £26,250 for 1910. In view of the impending purchase by the L.C.C. of the company's tramway between Finsbury Park and the Manor House—a short, but very important section—they promoted a Bill last Autumn, asking Parliament to sanction a new tramway between these points running parallel with the existing tramway and situated within a portion of Finsbury Park. Prior to second reading, they were able to come to an understanding with the London County Council, by which they agreed to negotiate with the company for through running powers to the London termini, and, therefore, they had been able to withdraw their Bill. At the sitting of the Council on the previous day they had agreed to the running of a through service from the Tottenham Court Road to Enfield. The successful results lately obtained by the London General Omnibus Co. led that company to enlarge the sphere of their operations, and the number of 'buses running within the area of the company had considerably increased during the past year. With a view to opening up districts in their area not yet served by tramways, and with the object also of preserving the undertaking from an increase of motor-'bus competition, the directors had since the commencement of the year joined with the British Electric Traction Co. in the formation of a new omnibus company under the title of the Tramways Metropolitan Omnibus Co., Ltd. The object primarily was to protect the terminal points of their tramways. The new company had been incorporated with a capital of £200,000 divided into 200,000 shares of £1 each, all of which had been subscribed for as to half by their company and as to the other half by the British Electric Traction Co. They thus held 100,000 shares in the new company, on which 1s. a share had been paid. The new company had created and issued £100,000 4½ per cent. debenture stock, which had been guaranteed both as to principal and interest by their company. Therefore they had a strong financial interest in the new venture. Mr. Devonshire, their managing director, was chairman of the new omnibus company. The directors of the omnibus company anticipated that they would in the course of the present year put into operation 100 up-to-date omnibuses, which were to be worked in connection with their tramway system as feeders. It was also proposed to have a system of through bookings between their omnibuses and the tramways. It might be a little difficult for them to understand all the reasons which had actuated the directors in adopting this policy, but it was the subject of most earnest consideration, and they did not decide on the policy until after they had exhausted all efforts to come to an understanding with the London General Omnibus Co. The chairman then referred, at some length, to the test case fought by the company in regard to the assessment of their tramways in the Tottenham district, the decision of the Court of Appeal being that tramways were rateable on the same basis as railways and tramroads. He pointed out that the decision was not necessarily a final one, as the local authority might appeal to the House of Lords, but the three judges were unanimous in holding that the tramways were entitled to the exemption. The point was of great interest to the whole of the tramway industry, and in their own case it meant a saving of approximately £1,100 a year. With regard to the coal strike, they decided, after consultation, to reduce the service to the extent of about 20 per cent. of the car-mileage, and that had been in operation since March 18th. So far as they could see, it would not be necessary for them to shut down any of their lines altogether. Nevertheless, the strike caused them very considerable anxiety, for not only had the cost of coal gone up, but the price of all other materials was tending to rise, and their working expenses during the current year were almost certain to show a large increase. The matter was under the very careful consideration of the directors, as it might unavoidably involve the necessity of raising fares. They could not come to a decision in the matter without conference with the Middlesex County Council, but he felt bound to mention it, as it might have a far-reaching effect on the company during the current year. After briefly referring to the figures in the balance-sheet, the chairman referred to a letter received from a deferred shareholder, asking why they did not put less to reserve and pay something to the deferred shareholders. He explained the circumstances under which these shares were created. When the company took over the remaining property of the North Metropolitan Tramways Co., they issued preference shares up to the real value of the property taken over, and then, to facilitate the arrangement, they gave deferred shares, which would be entitled to a dividend when the company had paid 8 per cent. Those deferred shares really represented no assets. There was no doubt that with the increased dividend being paid on the ordinary shares, an agitation would be commenced by the deferred shareholders, which would not be a good thing for the company. With the difficulties they had to face, and with the necessity of maintaining the permanent way, he would be very sorry if shareholders were led to expect a large and rapid increase in dividends. They were now paying 6 per cent. dividend, and it would be the policy of the board to maintain it before they made any great efforts to increase it. At the same time, to prevent disappointment to the deferred shareholders, the directors would seriously consider whether it was practicable to formulate some scheme by which they might adjust the conflicting interests of the two classes of shareholders. In conclusion, the chairman paid a high tribute to the hard work and loyalty of the officers and staff.

Sir E. Spencer seconded the motion.

Mr. Ennis supported the chairman's statement as to the desirability of doing everything possible to maintain a steady dividend, and expressed the hope that no higher dividend would be paid until the item of preliminary expenses was dealt with.

The Chairman said he quite sympathised with Mr. Ennis's view, and they would see what could be done.

The report was adopted, and the retiring directors and auditors re-elected.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Monterey Railway, Light, and Power Co.—Further issue of £200,000 5 per cent. first mortgage debenture stock.

Pennsylvania Water and Power Co.—Further issue of $100,000 first mortgage sinking fund 5 per cent. gold bonds of $1,000 each (Nos. 7,281 to 7,580).

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Puebla Tramway, Light, and Power Co.—$3,000,000 prior lien 5 per cent. 50-year gold bonds.

Rio de Janeiro Tramway, Light, and Power Co., Ltd.—Further issue of £218,000 5 per cent. 50-year mortgage bonds.

Direct United States Cable Co., Ltd.—The board announces a final dividend of 2s. per share, together with a bonus of 1s. per share (less income-tax), payable 30th inst., making with the two interim dividends already paid a total distribution of 5 per cent. for the nine months ending March 31st. The accounts will in future be made up to March 31st in each year. The transfer books will be closed from April 15th to 29th.

Edgar Allen & Co., Ltd.—The directors have declared a final dividend on the 5 per cent. cumulative preference shares for the year ended March 31st.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2½d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£24 10	£1 15 inc.
a Lead, Nitrate	,,	£26 10	£1 10 inc.
a ,, White Sugar	,,	£25 10	10/- inc.
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£67	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c ,, Tube (brazed)	,,	10½d.	½d. inc.
c ,, ,, (solid drawn)	,,	9d.	½d. inc.
c ,, Wire, basis	,,	8½d.	½d. inc.
c Copper Tubes (brazed)	,,	11½d.	½d. inc.
c ,, ,, (solid drawn)	,,	10½d.	½d. inc.
g ,, Bars (best selected)	per ton	£86	£2 inc.
g ,, Sheet	,,	£86	£2 inc.
g ,, Rod	,,	£86	£2 inc.
d ,, (Electrolytic) Bars	,,	£79 5	£3 5 inc.
d ,, ,, Sheets	,,	£91 5	£3 5 inc.
d ,, ,, Rods	,,	£79 5	£3 5 inc.
d ,, ,, H.C. Wire	per lb.	9½d.	½d. inc.
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	5/-	½d. dec.
f Iron Pig (Cleveland warrants)	per ton	52/1½	6½d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£16 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 12 6	..
e Mica (in original cases) small	per lb.	6d. to 2s.	..
e ,, ,, ,, medium	,,	2/6 to 4/-	..
e ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	165/-	..
d Silicium Bronze Wire	per lb.	10d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£200 to £202	£1 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£29 5	£1 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange on returning from its Easter Holidays, found the usual accumulation of orders, which resulted in the markets wearing an appearance of decided animation for an hour or two during the morning, after which there was a slackening tendency, both as regards trade and, in some directions, as regards prices also. However, there is a general cheerfulness in the financial world which finds expression in the greater willingness on the part of the public to embark upon speculative investment. In one section and another there is a good deal of business about, and the conclusion of the coal strike gives an added fillip to the appetite for public purchases of stocks and shares. Mr. Lloyd George's Budget, humdrum in most of its characteristics, and of questionable soundness in the rest, had the effect of depressing the price of Consols; though here again there was a recovery after the fall.

In the Home Railway market, the activity continues to be marked in all of the Underground Railway descriptions. A good deal of interest is absorbed by conflicting rumours, reports, and statements respecting the Central London Railway; and, reading between the various lines, it would appear as though the company were holding out its hands to one of its bigger neighbours with a view to seeing which one would like to take it under its own control. The Preferred stock rose 1, but the Ordinary and Deferred have both given way on sales made before the settlement by those who had good profits available, and by reason of the threatened trouble amongst the company's men. City and South London put on a point. Great Northern and City Preferred are 5s. to the good, having risen £1 in a fortnight. Districts, after being 47¼, fell back to 45½, from which there has again been a sharp recovery; leaving an advance of 4¼ on the week; while Metropolitans went ahead in good style. The market argument that both Metropolitans and Districts are over-valued at their present quotations does not imply that there is no room for further appreciation, and it is recognised that to be a "bear" of either stock is a dangerous proceeding. Underground Electric shares touched 4 1/16, reverting to 3½, and at 3¾ are ⅛ down on balance, the Income bonds keeping very firm at 89. Metropolitan Electric Preference are a shade harder, and the Deferred shares at 3s. 9d. middle have put on 1/16 in consequence of the attention drawn to them by reason of the good report out recently. British Electric Traction continue a very dull market, and London United Trams show no change.

In the foreign tramway group, the Canadian-Latin issues are mostly in strong demand. One or two of the Mexican bonds are still rather under a cloud in consequence of the revolution, but otherwise speculation is rife in many of the lesser-known things, as well as investment in the better-class bonds. Rio Trams have risen 2½. British Columbia Electric Railway stocks are strong, especially the Preferred Ordinary, which gained 2½. Sao Paulos at 202 are 3½ higher. Montreal Common shares spurted 10½ points. Such shares as Alabama Light and Power, which are comparatively little known, shot into prominence, and were brought up to 43½—a jump of about $8 on the week. Georgia Light Railway shares, another comparatively unknown share on this side, are being sought after on the basis of 38—39. Speculation will, no doubt, put all these things too high, and there is far too much of buying on mere tips. However, if the public are keen on having such things, the critic can only utter warnings which he knows pretty well will be flung to the winds: and, moreover, if he happens to have a sneaking conviction that such shares are likely to go considerably better, the warning will be tinged with a reservation of half-reluctance.

The telegraph market continues to be absorbed by the magnitude of the dealings in Marconi shares. The world seems to have gone mad after these, and buying goes on from all quarters. It is contended that the company is now in a position far superior to anything that it has ever occupied before, and that on this ground the current quotation is justified. We are not going to attempt to say whether this is the case or not; it is sufficient to note that much of the buying has been of good class, and that the prospects favour the idea of a further advance. On the week there is a substantial improvement again exhibited, although at one time last Thursday the market was seized with a fit of flatness. Spanish hold their price with remarkable tenacity, but there has been selling in Canadians which caused the price to give way smartly to 3½8.

Eastern Telegraph stock and Eastern Extension shares have commenced to recover from the depression which put them down two or three weeks ago, when Marconis were rising hand over fist. Both show an improvement, and the recent selling has ceased. Anglo-American Telegraphs are unchanged upon the declaration of the usual quarterly dividends, and Great Northern at 32¼ have not moved upon the announcement of the final dividend of 13 per cent., making the regular 18 per cent. for the year. West India and Panama gave way again, the Ordinary shares falling to 4¼. Reuters eased off 5s. in connection with the new issue. National Telephones have been going ahead again, and the Deferred stock is talked many points higher yet. The gamble was aptly described as a giddy one, for nobody can tell what is going to happen.

Underwriters in the Consolidated Diesel Engine Company were left with a small amount of their application, and the price eased off to 1/16 discount for special settlement. The fact of two companies making somewhat similar engines coming out on the same day, no doubt, had its effect in contributing to this; while the rumour runs that some of the underwriters took advantage of the pre-allotment premium, in order to make certain of a good profit. Still, it must be remembered that the issue was a comparatively big one, and it is not altogether surprising that the results should have turned out in this way.

The raising of the dividend on Babcox & Wilcox from 26 to 28 per cent. was in accordance with general expectations, and the price of the shares remained unchanged at 6¼. The company's statement has been received with a great deal of satisfaction, and when the shares are quoted *ex* dividend, it seems likely enough that they will recover at least part of the deduction. Callenders have had a big rise, and Westinghouse 4 per cent. Debenture is 1½ higher. The Manufacturing market, as a whole, is steady, without showing any special changes, apart from those just mentioned.

The London lighting group is marking time. City Lights lost 10s. of their recent big improvement, and County Ordinary went back 5s. The County Company's new issue was a decided success. For Special Settlement the price of the new shares is ¼ premium. Kensingtons come out best this week, with a jump of 12s. 6d. Somewhat overlooked up to the present, a very little demand served to put up the price sharply, the market being none too well supplied with shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations April 9th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	8½ — 9½ xd	..	5 19 0
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10¾ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	10†	8½ — 8¾ xd	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8¼ xd	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	95 — 98	+1	4 1 8
Chelsea, Ord.	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	18 — 19½	— ½	4 2 1
Do. 6 % Cum. Pref.	10	6	6	13¾ — 15½	..	3 17 5
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	101 —104	..	4 6 7
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	6	10 — 10⅝	— ¼	5 11 7
Do. 6 % Pref.	10	6	6	11⅛ — 11⅝	..	5 3 0
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb.	Stock	4½	4½	101 —104	..	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2¼ — 2½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6½ — 7½	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	9	7⅜ — 7⅞	+ ⅛	5 14 3
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	8	2	2½	1⅜ — 2½	..	3 11 2
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	+ 1	4 5 1
Metropolitan	5	5	4†	3⅜ — 4⅜	..	5 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne	5	4	4†	3¾ — 3⅞ xd	..	5 3 3
Do. 5 % Pref., Non-Cum.	5	5	5	3¾ — 4⅛ xd	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅝	..	..
South London, Ord.	4	5	5	2⅜ — 2⅝ xd	..	5 8 0
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅝ — 1⅞	+ ⅛	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	95 — 98 xd	..	4 11 10
Urban, Ord.	5	5	..	⅜ — ½	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 87 xd	..	5 3 6
Westminster, Ord.	5	10	10	8¾ — 9½	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	7†	6½ — 7½	..	5 17 3
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 3
Canadian Gen. El. Com.	$100	7	7†	116 —120	+3	5 16 8
Do. 7 % Pref.	$100	7	7	116 —120	+2	5 16 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅜ — 1⅜	..	2 18 3
Do. 5 % Deb.	100	5	..	93 — 98 xd	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	+1	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	91 — 93	—1½	5 7 6
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 9/16	..	Nil
Do. 6 % Pref.	1	6	6	¾ — ⅞	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	110 —112	..	4 9 3
Madras, Ord.	5	..	..	2½ — 3	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84 — 86	— ½	5 16 3
Mexican Lt. & Power, Common	$100	4	4†	84 — 86	—1	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	105 —107	..	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	— ½	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87½ — 89½	— ½	5 11 9
Montreal, Lt., H. and Power	$100	7	8	208 —213	+10½	3 15 2
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	..	252 —262	+4	3 16 4
Do. 6 % Non-Cum. Pref.	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	102½ —104½	..	4 15 8
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101 xd	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	141 —145	+4½	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ —105½	..	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¼d.	3/16 — 3/8	— 1/16	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½ —106½	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅜	— ⅛	..
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150 xd	..	5 6 8
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3½	3	66 — 68	..	4 8 6
Do. 6 % Pref.	Do.	6	6	109½ —110½	— ½	5 8 7
Do. Def.	Do.	30/-	30/-	24½ — 25½	..	5 18 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	100 —102	..	4 18 0
Chili Telephone	5	7	..	7¾ — 7⅞	— ⅛	4 15 0
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	85½ — 87½ xd	..	4 11 5
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝ xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7½ — 8¼ xd	..	6 1 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	..	7⅜ — 8½	+ ⅛	5 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	131 —135	+2	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	81 — 83	+1	4 4 4
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	+ ½	3 17 8
Eastern Extension	10	7	5†	12⅛ — 13	+ ¼	5 7 8
Do. 4 % Deb.	Stock	4	4	9½ — 10⅛	..	3 18 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	10½ — 11 xd	..	5 9 1
Do. 6 % Pref.	10	6	6	12⅜ — 13⅜ xd	..	4 9 9
Great Northern Telegraph	10	18	18†	32½ — 33½	..	5 8 3
Indo-European Telegraph	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common	$100	5	5†	81 — 84	..	5 19 1
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	..	7⅛ — 7⅜	+ 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	6 1/16 — 6 3/16	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	⅜ — ⅝	..	5 10 6
National Telephone, Pref.	Stock	6	6†	99½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	137 —139	+1	4 6 4
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	+ ⅛	4 9 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	+ ½	4 7 0
Oriental Telep. and Elec.	1	8	..	1⅜ — 1⅝	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅝	..	4 16 10
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	+ ⅛	3 18 10
Reuter's	8	5	5†	11⅞ — 12	— ⅛	3 6 8
Submarine Cables Trust	Cert.	6	6	130 —133	..	4 10 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅞	..	5 8 3
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4½	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 11½	— ⅛	5 8 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅞ — 10⅜	..	5 17 1
Do. 5 % Debs.	100	5	5	102½ —104½	+ ½	4 15 8
Western Telegraph, Ltd.	10	7	6†	13 — 13½ xd	..	5 3 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	102 —105	..	4 5 9

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations April 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 1/8	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 1/2	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	78 — 83 xd	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	11½ — 13½	— ½	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	90½ — 92½	..	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	86 — 89	..	..
Do. 5 % Perp. Deb.	100	5	5	93½ — 96½	..	5 3 8
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	83 — 85	—3	3 10 7
Do. Pref.	100	4	4	87 — 89	+1	4 10 0
Do. Def.	100	2	2	83 — 85	—3	2 7 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
City & South London, Ord.	100	1½	1½	43½ — 44½	+1	3 13 0
Do. 5 % Pref., 1891	100	5	5	108 —110	+1	4 11 0
Do. Do. 1896	100	5	5	103 —105	+1	4 15 3
Do. Do. 1901	100	5	5	102 —104	+1	4 16 2
Do. Do. 1908	100	5	5	102 —104	+1	4 16 2
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅝ — 11⅜	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	2⅜ — 2⅞	+ ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	1/8 — 3/8	..	..
Do. 4½ % Deb.	100	4½	4½	71 — 76 xd	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2¾	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	82 — 84	..	5 19 1
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3¾ — 4	..	..
Do. 4 % Deb.	100	4	4	75 — 78	..	5 2 7

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations April 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Metropolitan Railway Consol.	100	1⅞	1⅞	65⅜ — 66½	+2½	2 16 2
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	+1	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	..	47 — 47½	+4½	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	5†	33/32 — 1 1/32	..	5 6 8
Do. Def.	1	Nil	..	3/32 — 5/32	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	29/32 — 31/32	+ 1/32	5 10 6
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97 — 99 xd	..	5 0 0
Potteries, Ord.	1	2	..	13/32 — 17/32	..	..
Do. 5 % Pref.	1	5	5	15/16 — 29/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	3/4 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	..	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	3⅝ — 3¾	— ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	88 — 90	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 3/8	..	Nil
Do. 6 % Pref.	5	Nil	..	2½ — 3½	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5	5½	4⅞ — 5⅛	+ 1/16	5 7 4
Do. 4 % Deb.	100	4	4	9⅛ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	103 —105	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104 —106	+1	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞ — 11⅛	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	9⅜ — 9⅝	..	4 6 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columt ia Elec. Rly., Def.	100	8	8†	139 —144	+1	5 11 1
Do. Pref. Ord.	100	6	6	125 —130	+2½	4 12 4
Do. 5 % Pref.	100	5	5	111½ —114½	..	4 7 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	..	6 — 6¼	..	4 16 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	Nil	2½†	3/8 — 3/4	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 6 0
Do. 4 % Deb.	100	5	5	101 — 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/8 — 15/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0
La Plata Elec. Trms, Ord.	1	..	..	3/8 — 3/4	..	..
Do. Pref.	1	6	6	13/16 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	96½ — 98½	..	5 1 6
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½ —101½	..	4 18 6
Mexico Trams Com.	$100	7	7	118 —120	—1	5 16 8
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	— ½	5 2 0
Do. 6 % Bonds	100	6	6	100½ —102½	..	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅞ — 7⅛	..	7 0 4
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	98 —100	+ ½	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1 5/16	..	1 18 1
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	121½ —122½	+2	4 1 10
Do. 1st Mort. 5 % Bonds	..	5	5	103½ —104½	+ ½	4 15 8
Do. 5 % Mort. Bonds	100	5	5	96⅜ — 97½ xd	..	5 2 4
Sao Paulo Tram, Lt. and P.	$100	10	10†	201 — 203	+3½	4 18 6
Do. 5 % 1st Deb.	$500	5	5	104 —106	..	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	79 — 82 xd	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5⅜ — 6	+ ⅛	6 1 11
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	103½ —105½	+ ½	4 5 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 3/4	..	..
Do. 6 % Pref.	1	9	6	3⅜ — 3¾	..	7 2 2
Babcock & Wilcox	1	26	28	6⅜ — 6¾	..	4 1 5
Do. Pref.	1	6	6	1⅛ — 1⅜	..	3 13 10
B.I. & Helsby Cables	5	10	10	6⅞ — 7⅛	+ ⅛	6 18 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 13 9
British Westinghouse, Pref.	3	Nil	..	3/8 — 1	..	Nil
Do. Deb.	100	4	4	62 — 65	+1⅛	6 3 1
Do. 6 % Prior Lien	100	6	6	99 —102 xd	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/4	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/4	..	Nil
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	10⅜ — 11⅛	+1	6 14 6
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	98 —100	..	4 10 0
Castner-Kellner	1	17½	20	31⅝ — 32	+⅛	5 6 8
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	8	Nil	Nil	1/2 — 5/8	..	Nil
Do. Deb.	100	5	5	58 — 63	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 3¼	..	5 8 1
Do. Pref.	1	6	6	15/16 — 1 1/16 xd	..	5 12 11
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/8 — 2/8	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	75 — 78 xd	..	6 8 2
Electric Construction	2	Nil	2½†	3/4 — 1	..	..
Do. Pref.	2	7	7	1⅝ — 1⅞	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8¼	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9⅛	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅞ — 12⅛	..	6 2 6
Do. Pref.	5	4½	4½	4⅞ — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	9⅜ — 10⅜	..	..
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 17 7
Telegraph Construction	12	20	10†	33 — 35	..	6 16 2
Do. Deb.	100	4	4	99⅜ —101⅜	..	4 9 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 1/2	..	Nil
Do. Deb.	100	4	4	59 — 61	..	6 11 2

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3½ per cent., February 8th, 1912.

REVIEWS.

Electric Mains and Distributing Systems. By J. R. Dick, B.Sc., M.I.E.E., and F. Fernie, A.M.Inst.C.E., A.M.I.E.E. London: The *Electrician* Printing and Publishing Co., Ltd. Price 10s. 6d. net.

Not many years ago it could be truthfully said that there were few, if any, books of practical and theoretical value to the mains engineer. His library has grown of late years, and is still growing. The long-heralded "Dick and Fernie" is now added to it.

Authors of books on mains work are curiously at one in admitting that it is scarcely possible to theorise beforehand on questions of distribution. The authors of the work now under review are no exception, for they admit, in the first chapter, that synthesis is impossible, and that "the designing of a network is possibly as much an art as a science."

True as this view is, it is no less true that a really scientific engineer would much prefer to build up his mains system as he builds up his station and his boiler house, laying down in every part of his undertaking as nearly as possible what is required, neither under-estimating his demand, and so causing dissatisfaction, nor over-estimating it and so spending capital unprofitably. Experience is in all things the best teacher, and no matter what a man's training may be, he always has to go to the school of experience to finish that training—so far as a scientist can be said ever to have finished it.

To the mains engineer whose heart is in his work, such a book as that which we are now considering ought to be of considerable assistance. We say "ought to be" advisedly, for it is our painful duty to point out many instances where the industry of the authors in writing has been nullified by inaccuracy in printing and by careless revision. We do not intend to give a list of ordinary misprints, or places where the type is out of line, or pages are set askew, for if we did so the space available for an ordinary review would be entirely occupied with the catalogue. It has been necessary, in reviewing the book, to check every calculation and every formula used, and this, we are glad to say, is not generally the case, or the lot of the reviewer would be worse than it is already.

On page 10, in three places, formulæ are rendered utterly meaningless and inaccurate by the careless use of the sign of addition (+) instead of the sign of division (÷); and on page 14, in the first formula on the page, we see clearly that a sign of division has been roughly constructed by picking bits out of a "plus."

There is no list of errata (a true one would certainly have been terrifying to the possible buyer), and so one has to detect errors of this kind, which are as unexpected as they are annoying, without aid.

On page 12, after differentiating, we are given $\frac{-(c_1 + c_2)\, l_1}{K\, v_1^2}$ as part of the expression which is put equal to zero. l_1 should be l_1^2.

Again, on page 114, the squared index of the expression for the apparent resistance of a conductor, where the circuit contains capacity, is omitted in the second term.

There are some authors who start their work by making a list of the symbols which they will use throughout for various quantities or conceptions. This has not been done in the present case, for we have sometimes s for cross-section and sometimes a_1, a_2, and so on. K means capacity in farads in one line (page 114), and capacity in microfarads in the next line but one. On page 33 a distributor is variously described as A B and F, and later we are given F_1 and F_2 for distributors, while D_1 and D_2 are the feeders.

On page 26, recourse is had to a footnote to explain symbols, and we commend to the notice of the authors—and of all who intend to write books in which mathematical formulæ will be used—the practice before mentioned, of providing a glossary at the beginning.

On page 51, line 21, the word "joints" should be "points." There are instances of omitted words on pages 67, 207, and 221, while a redundant word is found on page 116. Fraction lines are omitted on pages 101 and 127, and there is no number under fig. 88, on page 242.

On page 125 a three-phase delta-connected system, shown as part of fig. 53, is described as "Two-phase four wires," while a star-connected three-phase four-wire system is called "Two-phase three wires"—descriptions which clearly belong to, and are correctly repeated under, fig. 54 on page 126.

Then we meet some curious chemical notions. On page 204 we are introduced to "phenol phalein," which is known in the laboratory as "phenol-phthalein." On page 207 we are greeted by the news that "lead oxides . . . will slowly turn to carbonates by absorption of Co_2," that is to say, by the absorption of two atoms of metallic cobalt! Carbon dioxide, as everyone knows, is CO_2.

So we could go on pointing out instance after instance in which serious carelessness in revision has occurred. We do not, in fact, at all like the way in which the book is printed. The advertisements among the contents list, and the method adopted of beginning a chapter on a right-hand page, which leaves 12 completely blank pages and many partially unoccupied, might very well be dealt with differently in a new edition. We are really very sorry and disappointed that a book which we have anticipated with some pleasure should have been published in such a grievous state. It would not be too much to say that the present issue should be called in and revised, for as it stands now the book is practically useless except to the mains engineer who is already sufficiently expert to be able to do without it.

When we reach the descriptive and practical parts of the book, however, we are glad to find a different state of things. There is a complete absence of all that would tend to make it into a kind of catalogue of different appliances, and the extensive experience of both of the authors in the work of which they are treating, provides us with useful, instructive, and highly interesting reading.

The shrewd remarks about workmen which we encounter in various places; the fearless and straightforward way in which results of experience are given; the careful diagrams of appliances for use with mains systems; all these are deserving of high praise and of the most careful attention.

So also are the care and attention bestowed upon points which are apparently small and likely to be overlooked, such as—to take one out of many instances—the necessity of using gun-metal nuts on iron screws in buried fittings, so as to do away with the trouble frequently experienced through rusting.

There are useful tables at the end of the book, and so far as they can be tested, they are correct. The index is complete, and we like the method of selecting the more important entries by means of heavy type, whereby much time is saved.

We think a lighter paper might with advantage have been used, and space should be economised as far as possible. However great the utility of a book may be in itself—and (properly printed) the utility of this book could surpass that of any other on the mains engineer's bookshelves—that utility is always considerably enhanced by portability and convenience.

We trust that we shall soon see a second edition, carefully revised, and embodying the suggestions we have offered in the endeavour to render the book more useful to those whom it is intended to benefit. When this consummation has occurred, "Dick and Fernie" is likely to become the standard English work on the subject with which it deals.

Revolving Vectors: with Special Application to Alternating Current Phenomena. By G. W. Patterson. London: Macmillan & Co. Price 4s. 6d. net.

In his prefatory note the author refers to the great advance in the use of vector methods of treating alternating current problems due to the work of Dr. C. P. Steinmetz. It is in consequence of this advance that more than one book has appeared within the last year or two dealing with the subject of vector analysis applied to alternating-current phenomena. For many students, the introductory treatment to be found in Steinmetz's own books is too brief, leaves too many questions unanswered, and appears at first to be too arbitrary for a clear perception of the subject to be gained on a first reading. A need is consequently felt for a more detailed explanation of vector methods and for a more

systematic examination of the symbols and expressions which arise. We believe that it has been with the intention of fulfilling some such function as this need suggests that the author of the present work has undertaken his task.

By the study of some book like the one now before us, which is kept on strictly theoretical lines, a student will realise something of the methods and scope of vector analysis, as employed by such writers as Steinmetz in the solution of the practical problems which arise in connection with electrical engineering.

Dr. Patterson assumes his readers to be possessed of a fair knowledge of mathematics, such as should be expected of a third-year student in one of our day technical colleges. He begins with a chapter dealing with the effects of the roots of (-1), when regarded as operators producing rotation of direction. If the critical reader takes exception to the expression just used, "rotation of direction," we can only say that it is difficult to describe more clearly the function of the operators dealt with in the first three chapters of the book. The author draws no clear distinction between a direction, a straight line, the position of a point (as expressed by the sum of its rectangular co-ordinates) and a vector. An operator is made to act indiscriminately on any of these, and to produce what we have called a "rotation of direction."

Chapter 4 deals with simple harmonic quantities, and introduces the reader to the relations between current and electromotive force in a simple alternating circuit and in circuits connected in series or in parallel. Although the problems here are more concrete, and such as will be readily followed by the student, we feel moved to make the same kind of criticism of the author's treatment which we have already hinted at in connection with the first chapters. We can imagine the student continually asking the question, "What is a revolving vector?" and hunting through this chapter, where he might reasonably expect to find the answer to his question, but hunting without success.

The nature and meaning of the symbols employed are not so clearly stated that the student can always realise what is being done when a mathematical operation is introduced. In fact, it would almost seem as if the author did not desire that the reader should obtain too near a view of the pitfalls which beset the inquiring mind. Thus, he occasionally seeks to prevent his shying at possible dangers by introducing such passages as "We may, therefore, fearlessly deal with impedances just as though resistances and reactances had, in fact, perpendicular (or quarter-period difference) relations."

In Chapter V, which deals with the product of two harmonic quantities, the author seems to throw off the guise of a cautious and protecting guide, and to lead the reader at once into the middle of one of the direst quagmires, from which he indicates only two tortuous and difficult exits. He begins this chapter by obtaining the product of two harmonic quantities, and then proceeds at once to confront the student with a *reductio ad absurdum* (to use the author's own expression) by applying the same method which he has just used in order to obtain the product of an alternating current and an E.M.F., and then showing that the result is not the power of the circuit. He then suggests two arbitrary methods of multiplication, either of which, if applied in this case, will give the correct answer. Of the reason for the failure of the first method, or of that for the success of the arbitrary methods, he attempts no explanation. Indeed, it is difficult to see how a treatment which appears to avoid, of set purpose, any distinction between vector and scalar quantities, and the difference between the expressions for vectors and for complex numbers, could afford any simple explanation.

The remaining chapters of the book contain applications of the rules and methods previously obtained to problems of various kinds, all of which are treated from a rather abstract and mathematical point of view, and without concrete numerical examples. The problems treated of include the determination of the power in balanced and unbalanced polyphase circuits, oscillatory and non-oscillatory discharge of a condenser, power and power-factor in circuits carrying non-sinusoidal currents, magnetically interlinked circuits and transformers.

In trying to arrive at a general estimate of the practical value of the book, the reviewer is bound to confess himself disappointed. From a purely mathematical point of view, he has found much that is interesting. On the other hand, from the standpoint of an electrical engineer, the book seems to offer little help either to the student or to the practician. It neither forms a satisfactory introduction to the works of Steinmetz, nor does it offer a system of notation which can be compared with his on grounds of practical utility. The author draws no clear distinction between the two meanings which are to be attributed to the symbol j. The symbol is used to indicate "unit normal vector," while it is also used to represent an operator producing rotation through 90°. The same ambiguity is, of course, to be found in Steinmetz's notation. But while using Steinmetz's symbol j, the author does not make use of the further simplifications, which render the Steinmetz notation of such great practical value to electrical engineers. In fact, the equations given by Dr. Patterson are sufficiently formidable in appearance to frighten the majority of engineers from their use, although they do not possess any corresponding increase in accuracy over the simpler and much more convenient forms employed by Steinmitz.

It is to students of mathematics and physics, rather than to electrical engineers, that the author must look to find readers of his work.

SOME THOUGHTS ON PUBLICITY.

By C. H. WORDINGHAM, M.Inst.C.E.

Central electrical stations, or rather the engineers designing, operating, and managing them, have from the inception of the industry of generating and distributing electrical energy suffered, and suffered badly, from epidemics of fashion. At one time, the fashion was a particular kind of current, alternating or continuous; at another, a special make of single-acting engine; later, exhaust steam turbines, and so on, *ad infinitum*. At present the plague takes the form of "more publicity"; this is the panacea (to reverse the metaphor) that is to cure every ill, to gloss over every defect and to fill the coffers emptied by the rapacity of the capitalist who demands interest on his capital, by the audacity of the workman who demands more than all the profits for his labour, and by the mendacity of the politician who says he wants the lion's share of the earnings of capitalist and workman for the good of mankind.

The charge was recently brought against engineers by Mr. Couzens, speaking at the Institution of Electrical Engineers, that they, as a body, adopted a lordly spirit of aloofness, and looked with disdain on the commercial side of their work. Is this true? Is it not rather a contradiction in terms to speak of a non-commercial engineer? Surely it is of the essence of the work which the word engineering denotes, that its practiser should have regard primarily to the cost and financial result of his designs and schemes. It is this vital condition that distinguishes the engineer from the natural philosopher or, to use the modern, though somewhat objectionable word, scientist. The latter pursues knowledge for its own sake by experiment and reasoning without any regard to the commercial usefulness or financial result of his work; the former is beset at every turn by the questions, "Will it pay"? "Is this design, good though it obviously is for effecting its purpose, such as can be made and sold at a profit at a price that people will pay?"

With all respect to those who think the average engineer is a scientific dreamer who wants teaching that commercial considerations must receive attention, who wants hustling, who must "wake up," and who must have applied to him any number of other catchwords, it is greatly to be doubted whether he deserves any of the reproaches so lavishly hurled at him.

The burden of the song is "Advertise." No one in these days can doubt that if a man has anything to sell he must advertise, for, unless a possible purchaser knows that an article is on the market, he cannot consider the question of

whether he shall buy it. But surely it is of little avail to tell a man that an article is in existence unless it is really useful to him, and actually fulfils the promises made in the advertisement both in letter and in spirit. With the one exception of patent medicines, no article can meet with permanent success, however skilfully boomed, unless it is, in fact, good of its kind, and it would be well if those who clamour for more publicity would first ascertain that the articles, the small utilisation of which they bemoan, effect their object commercially as well as scientifically. It is strongly to be suspected that those who call loudest for more commercial-mindedness are the very persons who fail to recognise that what they advocate is not a commercial proposition to the ordinary householder.

Now what are the possible applications of electrical energy in the ordinary English household? Let us realise what kind of people we are dealing with when we contemplate catering for the great bulk of those now using coal, oil and gas. The householder with a well filled servants' hall, with dozens of bedrooms filled with hungry guests wanting to be fed, tarnishing huge quantities of plate in the process, who shed hundreds of dirty boots that must be cleaned, soil presses full of linen that must be washed, mangled and ironed, who curl their hair from morning to night, light cigars every few seconds, make dust that must be evacuated almost continuously, and generally give employment to multifarious ingenious applications of electrically-driven machines, are few and far between. No, the prosaic people who might consume electrical energy, and who do consume gas, oil and coal are those who keep two "generals" (called by courtesy cook and housemaid), or more often one, and who have to look to every penny to keep their expenditure within their means. Let us take a few concrete cases and see what possible inducement there is to such people to use the articles referred to.

A very nice vacuum cleaner can be bought for £10 to £25. What will it save? If the servant is a good one, it will enable her to stand instead of her having to go down on her hands and knees, but a Ewbank would do this (though at the expense of damaged skirting boards and furniture within its line of erosion), and some wholesome muscular effort will be saved, but not a penny will come off the wages. Owing to the modest scale of the domestic machine, a good deal more time will be spent on cleaning the floor; dusting will have to be done just as if the room were swept with a broom, for passing motors, &c., will provide the material to be removed. Net result, £20 or so spent and a certain amount of time lost.

Plate-polishing machines can be bought for about £6 each, boot-cleaning machines for about £23, cigar lighters for from 12s. upwards, and so on. But how can this expenditure be justified when the family plate can be easily cleaned by a housemaid by means of a rag and brush in a couple of hours, rescued from the *Family Herald* once a week? The boot-cleaning machine seems lightly loaded with one or possibly two pairs of "master's" boots per diem (mi-sus' probably will not stand blacking). The work of the cigar-lighter is quite as efficiently performed by a few dozen matches from a box taken out of a neat packet of a dozen purchased for 2¾d. per packet. "But look at the advantages of an electric iron." We will. This interesting article is listed at 12s. 6d upwards. Out of Lancashire the amount of washing done at home is mighty little. At most the iron is probably used a couple of hours a week. Two really nice ordinary flat-irons can be purchased at the Army and Navy Stores for 2s., and they will come 20 miles out free on an enclosure card if you make the order up to 5s. You can make them hot on the fire without perceptible abstraction of heat therefrom, and you can use them wherever you like without tying copper, rubber, and silk into knots.

In all these cases the cost of the electrical appliance is enormous compared with that of what it is a substitute for, and the saving in actual cost of the work done is absolutely nil.

Let it not be thought that it is sought to imply that any of the appliances referred to are useless or unpractical. Far from it; it is simply a case of standing costs on the part of both of the competitors. On the one side, the length of user is so appallingly short that the capital cost kills the use of the appliances (and this is true whether the consumer or some hiring authority finds the capital, for shifting the burden from one paymaster to another does not alter the financial result) and, on the other, the standing charges for domestic service, kitchen fire, &c., are no whit affected by the saving due to the machines.

In restaurants, clubs and large establishments generally the conditions are utterly different, and the load factor is such as to make the capital costs quite small relatively to the work done, and the saving in labour is real and actually enables the wages bill to be substantially reduced.

If these considerations be admitted as true, of what possible use is publicity in effecting the sale of the appliances to the ordinary private householder? Even if he be cajoled into a few purchases, more harm than good is done ultimately by the discredit entailed on electrical appliances generally.

Notwithstanding what has been said, there are certain outlets other than lighting for electrical energy in the case of the class of consumer referred to. Electric radiators have a special field, which they fill better than any other heating agent. In the drawing room they can be switched on before the doorbell is answered, thus giving, if of the radiant type, the impression that they have been going all day, cheering and warming the visitor who has just come from the outside air, and saving the expense of a fire kept alight all the afternoon for the sake of chance visitors, and very possibly nearly out when one does happen to call. Again, in the sick room, a radiator is absolutely innocuous, maintains an equable temperature without attention and involves no risk of noise, such as is entailed by putting coal on a fire, noise which may break the slumber of a patient whose very existence may depend on his getting sleep at a critical juncture. Again, in the winter, radiators switched on for a couple of hours at night and while dressing in the morning are quite satisfactory in lieu of a fire in a bedroom, and obviate the necessity for the sleeper being disturbed unduly early for the fire to be lighted, besides saving the trouble and cost of maintaining the fire during the day.

Electric radiators in rooms requiring occasional or intermittent heating have great advantages in such households as those under consideration. They effect great saving in coal, in kindling wood (the cost of which is by no means negligible), and in labour (possibly making the difference between having to employ three servants or being able to manage with two).

Electric hot plates for boiling small quantities of water, making coffee, boiling eggs, making toast and similar duties, are exceedingly convenient, and not costly to use. When used instead of methylated spirit stoves, they save much money, trouble, and danger. Most of these hot plates suffer from a radical defect in design which puts up the cost for energy, perhaps, 50 per cent. The majority have large heat capacity which entails the expenditure of energy to raise the temperature of the apparatus. When the hotplate is shut off, and the heating operations are stopped, this stored heat is necessarily wasted. For continuous working, the waste, only taking place at the end of a long run, forms a relatively small proportion of the whole expenditure of energy, but for intermittent working, the waste occurs every time the heat is turned off, and may readily form a large fraction of the total heat developed. Apart from the waste, the large heat capacity leads to great loss of time in intermittent working. The height of absurdity of design was reached in an egg boiler that was on the market a short time ago. This precious appliance, which according to the prophets only required publicity to sell it, took about a quarter of an hour to bring the water necessary to cook three or four eggs to the boil, though it is true it would go on boiling after the current was switched off for perhaps half an hour; the number of ordinary human beings, however, who like their eggs boiled for this lengthy period must be very limited, whereas most people would appreciate an appliance that would boil up a few ounces of water in two or three minutes.

When serious cooking is concerned, the case for electrically-produced heat is very different. No doubt large or small quantities of food can be cooked in an excellent manner under exceedingly cleanly and wholesome con-

ditions with extreme economy of heat, it being unnecessary to roast the cook as well as the meat, and under certain conditions an electric galley or range may be greatly superior in all ways to one fired in any other way, and in many cases it may be cheaper to run; especially is this likely to be the case in restaurants and places where floor space is scarce and expensive and solid fuel is inconvenient. We are considering, however, the case of the moderate householder, and we at once find a stumbling block which almost puts electricity out of court for such consumers, viz., the question of hot water. It is all very well to say that such and such a heater will give so many gallons in a certain time for a given expenditure of energy; so it will, but what a poor makeshift arrangement at best is offered in place of the ordinary hot-water conveniences in the average house. The kitchen range, merely by being kept alight, without forcing, will provide an ample supply of hot water which is laid on and can be drawn from a tap in the scullery, one or more lavatories, housemaid's sink, &c., and is available for a bath, or rather baths, at any time. If care be used in planning, the hot water pipes will prevent the cold water ones near them from freezing and will provide quite a useful amount of warmth in the bathroom and adjacent offices, while the hot water cylinder or reservoir will provide for convenient airing of the family wash. No attempt seems to have been made to meet this condition of things, and until it is met no amount of publicity will be of much avail.

It is hoped that enough has been said to show that the prime necessity for any great increase in the sale of electrical heating appliances (and it is in this direction that the chief augmentation of domestic demand must be looked for) is the provision of reliable articles that will readily meet the needs of the householder. This is the crux of the whole question and really what determines the potential demand; other subsidiary, but still important factors, are the first cost of the gear and the price of energy. The lower these both are, the wider-spread will be the use of electric heating, but even at high prices the demand will be good if a real want is well supplied.

Let us suppose that practical apparatus, not unduly costly, is available, and energy can be obtained at a reasonable price: what, then, is necessary to sell it? Unquestionably publicity, more publicity and incessant publicity. But the publicity must be of the right kind. The average householder is a prosaic person who has a good deal of the Scotch regard for bawbees, and is very far removed from an idiot. He may smile at a funny phrase or quaint picture, both of which are probably inferior, the one in wit and the other in drawing, to what he can find in his favourite weekly ha'porth or penn'orth of hashed humour; or he may gaze with admiration at toothy face and scantily clad figure, which, however, are probably less toothy and more covered than a penny postcard of a real actress, or, rather, *poseuse*; but will he go and lay out several pounds in consequence? Emphatically, no; if you want to capture his custom, tell him in plain non-technical language what the thing you want to sell him is, in suitable cases, broadly how it works, in all cases what you say it will do (rather less than more than it will in practice effect), what it will cost to run under certain conditions, with plain data to enable him to calculate what he will have to pay under his own conditions of user if they differ from those you have assumed. Remember you are trying to sell to an individual who not only learnt the first four rules of arithmetic at school, but who has had to apply them ever since in order to earn his bread and butter, and is probably much quicker at them than you are. After all, even electrical calculations do not call for a special brand of multiplication, division, &c. If you treat your prospective customer as an intelligent being, and you are offering him something that it would be to his advantage to buy, you will probably find that he justifies your assumption and demonstrates his intelligence by giving you an order, which action you will doubtless find convincing.

Let us take a case in point. Would any number of smiling old gentlemen looking at their lighting bills, any number of Faust-like demons, or any number of eclipsed suns have sufficed to sell any one particular make of carbon lamp, that differed only from other carbon lamps in having an excessive amount of publicity given to it, and have made the rest of the carbon lamp industry a vanishing one? By no means; what has effected this for the metal-filament lamp is its inherent, provable superiority to other lamps; it is the few cold definite figures vouchsafed to the public that have sold the lamp and not the array of pictures and witticisms. If this fact were appreciated and laid to heart, we should hear less of the short-comings and apathy of central station engineers, and of the want of intelligence of the public, and more of the booming trade in electrical appliances.

THE TROUBLE WITH THE ELECTRIC COOKER.

By H. E. GOODY, A.I.E.E.

It is not suggested that there are not plenty of good electric cookers on the market; the trouble is that they have been taken up so little.

For several years it has been established to the satisfaction of everyone, excepting those interested in the exploitation of coal-gas, that electric cooking is an economical, clean, and reliable method of preparing food. It is economical in two ways. With electric cooking the food suffers less from what may be called oven wastage, and the working costs are low indeed with electricity at 1d. a unit, and gas at 2s. 10d. per 1,000 cb. ft., and taking into consideration the fact that with the former method the food loses neither weight nor flavour, while with the latter it loses a large proportion of the one and all the other, it may be safely asserted that electricity for cooking is cheaper than gas. That it is cleaner than gas cannot be seriously disputed. The reliability of electric cookers is not quite so obvious, but if the guarantees of manufacturers go for anything, it is none the less a fact.

The position, then, is this: here we have a device which is superior in every way to the gas cooker, and yet there are only a few thousand of them in use in Great Britain. The writer can personally vouch for the fact that, in one of the largest of the metropolitan boroughs, there is not a single electric cooker connected to the mains.

The reason for this absurdly restricted use is perfectly clear. At present, if a man wants an electric cooker (and a great many do want them), he has to buy it outright, excepting in the very few districts where advanced supply companies hire them out. Now electric cookers are much too expensive to buy—you cannot get one under about £7 15s., and if you want one of respectable dimensions and moderate strength, you will find it listed at £11 11s. or thereabouts. In these circumstances, it is hardly likely that anyone but semi-millionaires will scrap the gas oven, which may be purchased for £5, or hired for 1s. 6d. a quarter, and replace it with an eleven-guinea electric cooker, which must be paid for on the nail.

The initial expense of the newer culinary method outweighs its advantages. Members of the electrical profession have for years been expatiating to friends and clients on the manifold perfections of the electric cooker; and in everything but price it has reached its approximate perfection. The designers have done their duty well; but the salesmen and the supply companies have failed miserably. It must surely have been apparent from the first that the mere intrinsic merits of the electric cooker would never make it a serious competitor of the coal-gas food-spoiler.

Several London supply authorities have recently opened showrooms; and it is a matter of personal knowledge that in some of these showrooms the inquiries after electric cooking apparatus average as many as five and six a day. The showroom attendants do all in their power to persuade inquirers to install this apparatus; they give instructive demonstrations of electric cooking, and burden the prospective customer with numerous, beautifully-illustrated lists. But when the question of cost comes up for discussion, negotiations are brusquely terminated. The gas companies have accustomed people to all sorts of culinary conveniences for a small quarterly payment, and it is not to

be expected that these will spend £10 or £12 on a new method, of which, after all, the chief advantage is merely cleanliness.

Englishmen, in spite of their reputed love for the morning tub, have never evinced that pure and hallowed affection for cleanliness *per se*, which is willing to make financial sacrifice for its gratification. And anyway, it is only the cook or the wife who suffers from the greasy, fume-evolving gas stove.

Probably, if it were only for the sake of having the very latest thing in cooking apparatus, people would be content to pay a larger quarterly rental for an electric cooker than for a gas stove. But a £12 cash payment is a little too much.

And yet, fatuously enough, supply companies apparently expect that people will go in for electric cooking on the present terms. At least, we must make that assumption, since quite a number of them have gone to the trouble and expense of issuing circular-letters and pamphlets anent electric cooking, without the slightest intention of formulating a hire, or gradual-payment system, in connection therewith. When the cookers obstinately refuse to sell, it is the habit of supply engineers to turn to the manufacturers and say, "Can't you make a cheaper cooker—one that can be sold for £5 or £6?" They do not seem to realise that the actual cost of the electric cooker is only a small part of the trouble; even if they could be sold for £5, there would not be two bought in London, by private persons, in a week. And in any case, it is probable that an electric cooker must always be more expensive, as regards first cost, than the gas cooker. For, after all, it is a complete gas stove (barring the burners, which are merely pieces of pipe with holes in them), with the addition of electric heating elements. And it is the heating elements that cost the money.

No! The blame for the extremely limited use of the electric cooker lies with the supply companies.

Three or four hundred electric cookers would constitute such a valuable load, that it is surprising that station engineers have not taken more energetic steps to secure it. It would pay them to hire out cookers at as low a rate as the gas companies, but there would be no need for that. The writer is convinced that thousands of people would not mind paying 5s. or 7s. 6d. a quarter for an electric cooker, and surely payments of this magnitude would secure to the company a sufficiently large return on its capital outlay.

Free wiring has been taken up most enthusiastically by supply authorities, and at charges which are not in the least likely to prove remunerative. The lighting load obtained by free wiring is almost negligibly small, compared with what might be obtained for an equivalent capital disbursement on electric cookers.

The extensive use of electric cooking apparatus would solve the "peak" problem, or, at any rate, reduce it to less uncomfortable proportions.

Supply authorities seem to have adopted a policy of *laissez faire*, which, if not actually arresting, is putting a very decided brake on electrical progress. The policy is, no doubt, largely the outcome of the municipal rule to which so many supply undertakings are subjected, and, perhaps, there is some excuse for unenterprising municipalities. Theirs is an unenviable position—between the devil of technical expertness and the deep blue sea of ratepaying indignation. But if they are to make anything of their electricity undertakings, they must be warned that it is time they paid more attention to expert advisers, and less to the sordid clamour of short-sighted ratepayers.

If a municipal supply authority has to borrow money in order to undertake the hire of cooking apparatus, it should be regarded as quite an ordinary business transaction, and it should give no ground at all for the extraordinary mouthings about municipal extravagance which every loan seems to excite in the locality concerned.

The Electrical Exhibition has been visited by many thousands of the lay public. There they have doubtless seen and admired electric cooking apparatus of all sorts, and a divine discontent with gas methods has been evoked. Are we to take no advantage of this discontent?—a discontent which, if ignored, will rapidly simmer down into the old rotten acquiescence with things as they are. Are we to meet the many inquiries which the Exhibition is sure to provoke with the blank impossibility of immense cash payments.

There will not be another electrical exhibition in London until six more years have elapsed, and if we miss this grand opportunity of encouraging (by the only possible means, namely, hiring) the use of electric cookers, we shall be guilty of a terrible wrong against the industry whose very life depends on continuous and untiring advancement.

There are only two methods of disposing of electric cookers (to any extent, that is to say). One is to hire them out, and the other is to scrap them, and give gas a clear but not, we regret to say, a clean, field. So far, the choice of alternatives has not been made, and manufacturers are waiting anxiously for the verdict of the supply companies. What is it to be?

ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(*Concluded from page* 563.)

18. *New Zealand.*—In 1884 an Act was passed by the New Zealand Legislature, entitled "An Act to consolidate and amend the laws relating to the construction, maintenance and protection of electric lines for purposes of communication and for other purposes, and to provide for the regulation thereof." Although this measure was primarily intended to provide for the erection and maintenance of telephone and telegraph wires, nevertheless it contained a series of provisions with regard to electric lighting, but it was repealed, and in substance re-enacted by the Post and Telegraph Act (No. 147, of 1908), which contains provisions for electric light. By Sec. 169 of this Act, any local authority having power by law to construct public works within the district under its jurisdiction may construct and maintain electric lines for lighting purposes within such districts as a public work, in like manner and with like powers, authorities, and liabilities as may by law be exercised in respect of, or as are attached to, the construction of such public works. Then by (Sec. 170) the regulation of lines for transmitting electricity for lighting and power purposes is provided for by the simple expedient of making the provisions of the Act as to telegraph lines applicable (*mutatis mutandis*) to power lines. By Sec. 172 the Minister, or any officer of his department, may grant and issue licences to any person desirous of putting up and maintaining lines for lighting purposes, subject to certain regulations for ensuring the safety of the public.

The Public Works Act, 1908 (No. 160), contains very important provisions with regard to the utilisation of natural sources of power in the Colony. By Sec. 267 (1) subject to any rights lawfully held, the sole rights to use the water in lakes, falls, rivers or streams for the purpose of generating or storing electricity or other power, vests in the Crown. The Governor may (by Sec. 27) delegate to any local authority, on such conditions as he thinks fit, the right to use water from any lake, fall, river or stream for the purpose of generating electricity. Outside a mining district the right to use water for generating electricity for lighting his own premises may be granted by the Governor to any person (Sec. 26 (*c*). By Sec. 272 the Governor may, by Order in Council, authorise the Minister to erect, construct, provide and use such works, appliances and conveniences as may be necessary in connection with the utilisation of water-power for the generation and storing of electrical energy. Notwithstanding anything to the contrary in any Act, it shall not be lawful for any local authority to grant to any person any right or concession for the purpose of either generating or using electricity as a motive power, without in each instance the previous consent of the Governor-General in Council duly gazetted.

By Sec. 335 of the Municipal Corporations Act, 1900, it is provided that subject to conforming to the provisions of the above measure, the Council of a borough as constituted under the Act, may do all things necessary to light the

streets and public places of the borough with electricity, and may supply electricity to all the inhabitants.

An Act was passed in 1896 (60 V., c. 47) which provided that "Notwithstanding anything to the contrary contained in any other Act, it is hereby declared that from and after the coming into operation of this Act, it shall not be lawful for any local authority to grant to any person any right or concession for the purpose of either generating or using electricity as a motive power, without in each instance the previous consent of the Governor by Order in Council gazetted."

Acts appear to be passed from time to time in Zealand for the purpose of giving county or municipal authorities power to contract with companies for the supply of electricity. Such Acts appear to recognise the principle of compulsory purchase. Thus by the Ohinemuri County Electric Power and Lighting Act (No. 18) of 1899, the chairman, councillors, &c., of the County of Ohinemuri were authorised to enter into a contract of this kind. By Sec. 2 of the Act it is provided that there shall be a Board of Control for the purposes of the Act, consisting of the Governor in Council. This Board of Control may make rules and regulations for the control of any persons contracting with the county authority in the interests of the public safety, and may from time to time alter such regulations. By Sec. 4, subject to the Electric Lines Act (1884) *(ubi supra)* and certain other Acts, the county authority "may contract with any persons or company for the construction and maintenance and working of an electric installation for supplying electrical energy for public and private purposes within the said county, and may for such purposes grant "all the necessary powers for breaking up or otherwise interfering with roads or highways" upon such terms and conditions and for such period not exceeding 42 years and subject to such regulations and provisions as may be agreed upon between the contracting parties. After the agreement is drawn up, it is provided, by Sec. 5, that there must be a submission of the question whether it shall be entered into or not to a poll of the ratepayers.

Sec. 7 provides that, in any such contract, there shall be an express provision entitling the county authority "at the expiration of the term mentioned therein, or earlier, if the parties to the said contract shall think fit, to purchase the installation and works erected in pursuance thereof at a price, in case the said County Council and other contracting party shall not agree, to be ascertained by arbitration in the manner provided by the contract." Then follow the significant words :—"In no case shall the county authority contract to pay or pay, nor shall there be included in the price to be ascertained aforesaid, any sum for goodwill. And any contract or undertaking on the part of the chairman, councillors, and inhabitants of the Ohinemuri County contrary to the last-mentioned provision shall be null and void to all intents and purposes whatsoever."

19. *Southern Rhodesia.*—In 1899 certain by-laws relating to electric light and power undertakings were framed by the Administrator. Part 2 of those by-laws contains certain important rules. Of these the first is that :—"No application for statutory powers to supply or use electricity for lighting or power (other than an application from the local authority of the district) will be entertained by the Government unless proof of the consent of every local authority having jurisdiction within the proposed area of supply to the application is deposited with the Admistration. By Rule 4, notice of an intended application must be given to every local authority, company, or person authorised to supply electricity under statutory powers within the district to which the proposed application refers, leaving the same at the offices."

By Rule 9, applicants for statutory powers to supply or use electricity for lighting or power must proceed as follows :—

They must publish notice by advertisement of their intended application, and every such advertisement must contain the following particulars :—(1) The objects of the application ; (2) the address and descriptions of the applicants ; (3) a description of the proposed area of the applicant's operations ; (4) the names of the streets in which it is proposed that electric lines should be laid down within a specified time ; (5) the address of an office in Southern Rhodesia, and another office within the proposed area of supply, at which detailed information in regard to the proposed operations of the applicants can be obtained.

20. *Tasmania.*—The Tasmanian Statute Book contains no measure which deals generally with the supply of electrical energy. In recent years, however, certain Acts have been passed, a study of which will serve to show the principles upon which the right to supply electricity will be conferred upon any municipality. In 1900 "an Act to make provision for lighting the town of Devonport by electricity or gas" was passed. It is provided by this Act that the board of the town of Devonport may take steps to ascertain the cost of providing a supply of electric light for the use of the inhabitants. Sec. 6 provides as follows : "The board is hereby empowered to compulsorily purchase land and to compulsorily acquire any easements which the board may consider to be necessary for the purpose of this Act, and for the purpose of facilitating and effectuating any such purchase of land or acquisition of easements. The Lands Clauses Act, except as hereby varied, shall be incorporated with this Act." The Lands Clauses Act here referred to contains provisions very similar to those with which we are familiar in this country. In order to develop their works and lay their wires, &c., the board are given the usual powers to break up streets, &c., subject to their serving the usual notices on parties interested (Sub.-Secs. 7-13). In the exercise of the powers conferred by the Act, the Board "shall do as little damage as can be, and in all cases where it can be done, shall make good such damage" (Sec. 14). They must also make compensation to all parties interested in any land other than land purchased by the Board in or upon which any works may be constructed, or which may be injuriously affected by the construction and maintenance of the works under the Act, or otherwise by the execution by the Board of the powers hereby conferred, for all damage sustained by reason of the exercise as to such land or water of the powers vested in the Board by this Act.

Sec. 17 contains the salutary rule that, in determining claims for damage, regard is to be had to any benefit which may be done or accrue to the claimant by, or as a result of, the provisions of the Act. Further, all claims must be made within three months of the notice stating that the works are about to be executed (Sec. 18). After the necessary works are constructed, if any owner or occupier of a house, building, or other premises in the area shall require a supply of electricity, a supply must be furnished by the board at their usual rates (Sec. 22). The Board may also grant a supply for motive power. It is lawful for the Board to make such a rebatement as they think fit upon all moneys owing to the Board for electricity supplied under the provisions of the Act, and which shall be paid to the Board not later than 14 days after demand has been made for payment thereof (Sec. 24). Secs. 30-33 give the Board power to supply electricity to places beyond the town. For this purpose they may make contracts with neighbouring local authorities.

Secs. 34-39 comprise the usual clauses for the protection of public electric telegraph and telephone lines. It is provided that the Postmaster-General may require the Board to erect their wires, &c., in accordance with the rules and regulations issued by the London Board of Trade. The Act also contains the usual clauses providing penalties for waste or misuse and for taking electricity without authority.

Another Act, entitled the "Longford Lighting Act, No. 44, of 1903," also appears upon the Tasmanian Statute Book. This measure follows very closely that which we have just considered. A similar Act was passed in 1904, entitled the "Deloraim Lighting Act," enabling the municipality of that district to supply electricity. It contains in Sec. 38 a provision which might often, in the past, have been made a feature of our own electric lighting Acts. That section provides that "the trustees"—that is to say, the persons obtaining the statutory powers—may supply electricity to places beyond the lighting district.

21. *Trinidad and Tobago.*—The principles upon which the supply of electricity for lighting purposes is likely to be authorised in Trinidad, may be collated from the Electric Lighting and Tramways Ordinance (No. 4, of 1901). It is well, however, before drawing any conclusion from this Act, to note the preamble which provides that :—"Whereas the

acquisition and consolidation of the existing electric lighting and tramway systems, and the joint maintenance, operation and extension of the same, under rules and regulations from time to time made by his Excellency the Governor in Council, would secure a more efficient service, and tend to promote the development of the town of Port of Spain and its environs, and otherwise conduce to the advantage of the public." It will be seen from this that the object of the measure was to consolidate the tramways, &c., used in and around the town of Port of Spain. As it is probable, however, that any subsequent legislation in Trinidad or Tobago would follow on the same lines, it may be useful to refer to some of the provisions of this Ordinance, *e.g.*, Secs. 7-70, which relate to acquisition, construction, maintenance and operation of electric works and lines other than tramway works and lines, and to the supply of electrical energy through such electric works and lines.

The undertakers, for the purposes of the Ordinance, are the Trinidad Electric Co., Ltd. Sec. 8 provides that "the undertakers shall not, at any time after the commencement of this Ordinance, supply energy on, or except for the purposes of this Ordinance, erect or lay down any electric lines or works beyond the area of supply otherwise than under the authority of the Governor in Council." It will be seen that this provision involves the principle of prohibiting supply except under a Government order, but the prohibition only extends to one company. It does not follow that supply by a private person would also be prohibited. The remaining provisions of this Act down to Sec. 10 are rules and regulations relating to the supply of electricity which follow closely upon the lines of the Electric Lighting (Clauses) Act, 1899.

The Straits Settlements have no Acts or Ordinances relating to electricity, and the laws of Uganda, which were published in a single large volume in 1910 contain no provision for the regulation of the supply of electricity.

5,000-KW. CURTIS TURBO-ALTERNATOR.

The British Thomson-Houston Co., Ltd., of Rugby, recently supplied a 5,000-kw. Curtis turbine to the County of London Electric Supply Co., for their City Road power station. The turbine is of the six-stage Curtis type, and has a normal rating of 5,000 kw., with an overload capacity of 50 per cent. when operating condensing, and is able to deal with three-quarter load when exhausting to the atmosphere in case of emergency. The turbine is constructed in accordance with the B.T.-H. patents, with the high-pressure steam admitted to the centre of the turbine; the steam passes through two stages in succession towards the governor end, and returning through passages to the centre of the casing again, passes through the remaining four stages in the other direction to the exhaust. By this method of construction high pressures and temperatures are removed from the end of the turbine, rendering the shaft packing problem easier to solve, and tending to keep the bearings cooler; also, since the casing end is subjected to a pressure very little above that of the atmosphere, the entire casing can be split horizontally without setting up excessive strains or deflection, and the turbine rotor is thus rendered easily accessible for examination and cleaning. The shaft packing employed is of the well-known carbon ring type which has been used with great success for several years by the B.T.-H. Co.

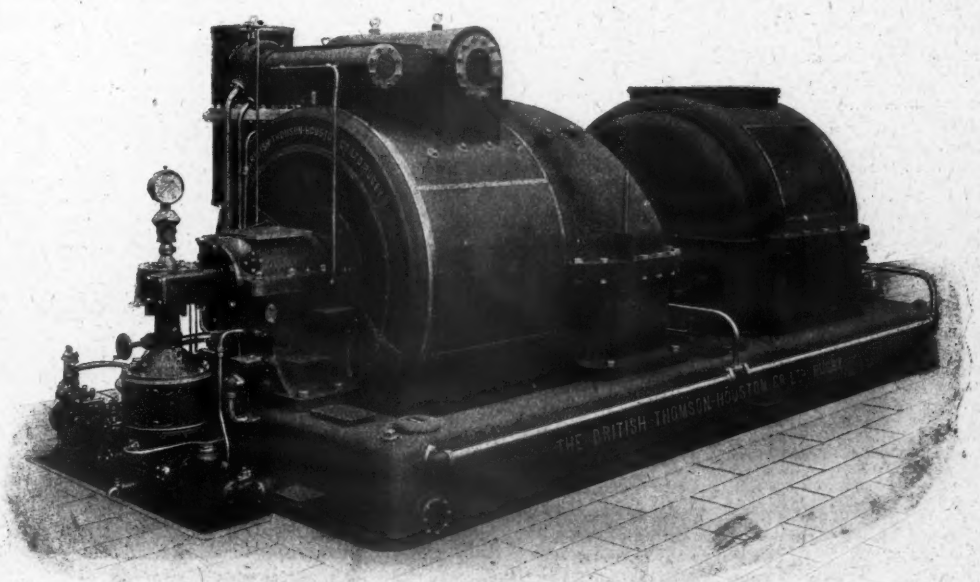
The two bearings are of the spherically seated self-aligning type, and contain cored-out passages for cooling-water circulation. The centres of the bearings are only 8 ft. 6 in. apart, which is an unusually short distance for a machine of this output, but is a desirable feature which is always noticeable in turbines constructed on the Curtis principle. The shortness of the shaft renders it possible, without employing extreme dimensions, to have the running speed considerably below the critical speed, so that no danger from whipping is to be feared when starting up or shutting down.

Steam is admitted to the turbine through several controlling valves, each of which regulates the supply to a separate group of high-pressure nozzles. These valves are opened in succession as the load comes on, by means of a rotary cam-shaft actuated by a hydraulic servo-motor controlled by the governor. As the governor has only to move a small pilot valve, a very sensitive governor can be used, and this type of gear is found to give excellent results, a speed variation of only 2 per cent. between full load and no load being easily obtained. At the same time, the gear is remarkably steady, and no hunting occurs. The hydraulic pressure for operating the servo-motor is obtained from the lubricating system, in which oil is maintained at a pressure of about 60 lb. per sq. in. by a gear-pump mounted on the governor spindle, the governor being driven by worm-gearing from the main turbine shaft. The suction of this pump is taken from an oil reservoir formed in the base-plate of the turbine, into which the overflow from all the bearings is discharged.

The generator has a normal rating of 6,250 k.v.a., in the form of two-phase, 50-cycle current at 2,200 volts per phase. The rotor has four poles. The overload capacity, which the machine is capable of carrying for two hours, is 7,800 k.v.a., or 25 per cent. above the normal rating.

In the rotor the exciting windings are carried in closed slots so as to avoid the use of wedges or other loose parts. At the ends of the rotor they are supported by massive rings on the outside, whereas, on the inside, they are freely exposed to the air in order to ensure proper cooling.

The generator has two bearings which are independent of the turbine bearings, and being driven through a flexible coupling it is capable of running satisfactorily even when slightly out of alignment. This is an important point in big machines, where heavy weights may cause slight settlement of the foundations. The exciter is driven through a flexible disk coupling contained within the alternator main bearing housing, and is also independent of exact alignment.



5,000-kw. Curtis Turbine, County of London Electric Supply Co.

Ventilation is effected without the use of any external fans, the rotor itself acting as a very efficient blower. The air for cooling purposes is led through ducts in the base-plate, and after circulating through the machine is expelled through an opening in the top of the stator frame. Before entering, the air passes through a

B.T.-H. filter, to prevent dust or other impurities from accumulating in the machine.

Special attention is drawn to the remarkably small space occupied by the turbo-alternator, the main dimensions being 10 ft. 6 in. wide, 29 ft. long and 10 ft. 3 in. high; at 5,000 KW., this works out to 16·42 KW. per sq. ft. of area, a paramount consideration where floor space is limited.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,211. "Electrical arrangements for protecting ships' bottoms and submerged structures from barnacles or aquatic life and the like." J. E. James. March 25th. (Addition to 14,181/10.)

7,242. "Signalling by means of electro-magnetic waves." F. J. Chambers. March 25th.

7,253. "Land storage-battery electrodes and processes of making them." W. Morrison. March 25th. (Complete.)

7,258. "Dynamo-electric alternating-current machinery." Akt.-Ges. Brown, Boveri et Cie. (Addition to 4,460/12.) Convention date, January 29th, 1912.) March 25th. (Complete.)

7,263. "Method of obtaining electricity from the air." H. N. Johannsen. (Convention date, March 25th, 1911, Germany.) March 25th. (Complete.)

7,264. "Automatic toll-recorder for telephone systems." E. G. Godfree. (Convention date, April 3rd, 1911, United States.) March 25th, (Complete.)

7,290. "Telegraph transmitting machines." F. De Asis del Valle Atiles. March 25th. (Complete.)

7,317. "Electrical apparatus for protecting the hulls of ships and other submerged structures from barnacles and other forms of aquatic life." J. E. James and W. T. Smith. March 26th.

7,330. "Automatic ballot-box, an electric apparatus by which a voter can record or register his or her vote." B. Graham.

7,359. "Lighting electrically-driven vehicles." H. Leitner. March 26th.

7,367. "Electrical furnaces." I. Rennerfelt. March 26th. (Complete.)

7,369. "Electrically-operated automatic piano and like players." J. T. Sibley. March 26th.

7,370. "Electrically-operated automatic piano and like players." J. T. Sibley. March 26th.

7,375. "Electric and automatic control of engines, dynamos, and batteries." L. Sunderland and G. C. Pillinger. March 26th. (Addition to 29,944, 1909.)

7,428. "Electric ignition apparatus for internal-combustion engines." C. F. Kettering. (Divided application on 5,902, March 2nd, 1911. Convention date, March 12th, 1910, United States.) March 27th.

7,490. "Electric ignition apparatus for internal-combustion engines." C. F. Kettering. (Divided application on 5,902, March 9th, 1911. Convention date, March 12th, 1910, United States.) March 27th. (Complete.)

7,495. "Electric signalling circuits for train despatching and like systems." J. C. Field. (Convention date, March 30th, 1911, United States.) March 27th. (Complete.)

7,467. "Rectifiers for high-tension alternating currents." Siemens & Halske Akt.-Ges. (Convention date, March 27th, 1911, Germany.) March 27th. (Complete.)

7,482. "Telephone apparatus." E. Grissinger. March 27th. (Complete.)

7,552. "Electric lampholders." H. Hale. March 28th.

7,572. "Electrical cut-in and cut-out devices for use in charging accumulators." H. Leitner. March 28th.

7,573 "Electrically self-winding clocks." F. H. Walker. March 28th. (Complete.)

7,574. "Winding the rotors of electrical machines." Siemens Schuckert-Werke G.m.b.H. (Convention date, March 28th, 1911, Germany.) March 28th. (Complete.)

7,577. "Brush-holders for dynamo-electric machinery." Akt.-Ges. Brown-Boveri et Cie. (Convention date, May 8th, 1911, Germany.) March 28th. (Complete.)

7,578. "Brush holders for dynamo-electric machinery." Akt.-Ges. Brown, Boveri et Cie. (Convention date, June 22nd, 1911, Germany.) March 28th. (Complete.)

7,591. "Protective devices for the conductor rails of electric railways." C. H. Merz and S. G. Redman. (Addition to 11,347, 1908.) March 28th. (Complete.)

7,595. "Microphones." G. Burney and Sterling Telephone and Electric Co., Ltd. March 28th.

7,643. "Electrically-driven dental engines and the like." S. M. Kropman. March 29th.

7,651. "Dynamo-electric machines." Electric Construction Co., Ltd., and N. Pensabene. March 29th.

7,657. "Instrument for measuring frequencies, self-induction, coefficients, and capacities." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) March 29th. (Complete.)

7,658. "Frequency indicator for alternating currents." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) March 29th. (Complete.)

7,697. "Single-phase induction regulators." Siemens-Schuckertwerke G.m.b.H. (Convention date, March 31st, 1911, Germany.) March 29th. (Complete.)

7,704. "Electric controllers." British Thomson-Houston Co., Ltd., and H. C. Hastings. March 29th.

7,729. "Lamp-holder for electric candle." E. J. Wilson. March 30th.

7,772. "Trolleys or overhead collectors for electrically-driven vehicles." R. Francq and V. Francq. March 30th.

7,775. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 30th.

7,780. "Electrical indicating apparatus." Soc. Courtaud G. Garnier Gil & Co. (Convention date, April 1st, 1911, France.) March 30th. (Complete.)

7,786. "Telegraphy." E. S. Heurtley. March 30th.

7,795. "Press-button switches." H. Wischhusen and A. Hepke. (Convention date, April 1st, 1911, Germany.) March 30th. (Complete.)

New Zealand.—H.M. Trade Commissioner for New Zealand, Mr. W. G. Wickham, has furnished a list of firms requiring the representation of British manufacturers in various classes of goods, including electrical goods. Apply to Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

PUBLISHED SPECIFICATIONS

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Time Mechanism for Operating Electric Switches, Gas Valves and the like. F. T. Reid. 25,607. November 4th. (May 4th, 1911.)

Polyphase Commutator Dynamo-Electric Machines. Allgemeine Elektricitäts-Ges. 27,993. December 1st. (December 1st, 1909.)

1911.

Control of Alternating-Current Electric Motors. S. Barbour. 8,489. April 6th. (Cognate application, No. 20,512 of 1911.)

Carbon Electrode for Electric Furnaces. L. E. Bussey. (Planiawerke Akt.-Ges. für Kohlenfabrikation.) 9,652. April 20th.

Electric Lamps for Motor Vehicles and other purposes. H. Lucas and W. H. Eggington. 10,968. May 6th.

Electric Current Limiting Apparatus. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz.) 13,815. June 2nd. (November 11th, 1910.)

Electrostatic Valves for Protecting Electric Circuits and Apparatus. N. Steels. 18,997. October 8th.

Branch Clamps for Electric Conductors. K. Walseck and H. Starcke. 20,987. September 22nd.

Interrupter for Electric Circuits. Firm of Robert Bosch. 25,880. November 19th. (June 13th, 1911.)

Insulated Railway Rail Joints. H. F. Roach. 27,940. December 12th.

Electric Ignition Devices for Internal-Combustion Engines. A. G. Bloxam. (Firm of Robert Bosch.) 28,518. December 28th.

Regulating Electric Tensions. H. Grob. 2,719. February 2nd. (February 4th, 1910.)

A Combination Electric Radiator or Heater and Humidifier. A. E. Wilson. 2,914. February 6th.

Method and Apparatus for the Measurement of the Specific Resistance of Electrical Conductors. Evershed & Vignoles, Ltd., and S. Evershed. 5,142. March 1st.

Lighting of Electric Incandescent Lamps. G. F. Richardson and R. J. Crowley. 6,066. March 10th.

Electric Accumulators. L. Fuller, G. Fuller and G. J. A. Fuller. 6,545. March 15th.

Dielectrics for Contact-Breakers. R. S. Wright and E. E. Burnside. 8,063. March 31st.

Dynamo-Electric Machinery. A. H. Midgley and C. A. Vandervell. 9,112. April 12th.

Brake Electromagnet for Tramway and like Vehicles. C. Shears. 9,475. April 18th.

Apparatus for Producing Electric Ignition in Internal-Combustion Engines. Firm of Robert Bosch. 9,840. April 22nd. (March 27th, 1911.)

Electrodes for Secondary Galvanic Cells. H. P. L. R. Porscke and J. A. E. Achenbach. 10,264. April 27th. (July 19th, 1910.)

Electric Signal Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 12,580. May 24th.

Fittings for Electrical Conduits. Barton & Sons, Ltd., and A. J. Harper. 12,860. May 29th.

Electromagnets. British Thomson-Houston Co. and E. B. Wedmore. 13,571. June 6th.

Process for the Production of Radio-Active Aromatic Compounds of Iodine and Bromine. A. de Szendeffy. 14,471. June 19th.

Mercury and other Vapour Electric Lamps. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 14,587. June 20th.

Electric Signalling Apparatus. R. B. Ransford. (Thrasher.) 15,052. June 27th.

Electro-Dynamometers, Wattmeters, Watt-Hour Meters and the like. Moore, Gambrell and C. T. Gambrell. 16,095. July 12th.

Control of Alternating-Current Electric Motors. R. H. Barbour. 16,361. July 15th.

Contact-Breakers for use in Electric Ignition Systems of Internal-Combustion Engines. B. Brooks and F. H. Alston. 16,875. July 24th.

Telephones. B. Hwozdz. 18,586. August 17th. (Addition to No. 17,268 of 1911.)

Electric Arc Lamps. Ges. für Maschinen und Metall-Industrie. 19,009. August 24th. (August 31st, 1910.)

Safety Device for Electric Cables. Siemens-Schuckertwerke Ges. 20,286. September 22nd. (May 2nd, 1911. Addition to No. 17,046 of 1911.)

Electric Heating Apparatus. J. Monnot. 23,815. October 10th. (October 14th, 1910.)

Manufacture of Electrical Accumulators. P. Marino. 26,265. October 21st.

Automatic Resistance Regulators for Telegraph Lines and the like. E. Belin. 25,158. November 11th. (Divided application on No. 9,536 of 1911. April 19th.)

Alternating-Current Commutator Electric Motors. H. K. Schrage. 26,152. November 14th. (November 21st, 1910.)

Method for Securing the Diaphragms in Microphones, Telephones, Gramaphones and like Sound-Reproducing Apparatus. W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon and Telegraphenwerke.) 25,420. November 15th.

Method and Apparatus for Localising Faults in Cables and Circuits. J. H. J. A. Stephenson. 25,683. November 17th. (November 18th, 1910.)

Telephone Instruments. Telefon and Telegraphenbau-Gesellschaft Ges. 26,516. November 27th. (June 8th, 1911.)

Electric Condensers. G. Seibt. 26,709. November 29th. (December 9th, 1910.)

Telephone Receivers. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 26,717. November 29th.

Circuit Systems for Operating Between Manual and Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 26,880. November 30th.

Adjusting Ring for Electric Ignition Devices for Internal-Combustion Engines. Firm of Robert Bosch. 26,928. December 1st. (August 25th, 1911.)

Protective Devices for Electric Lamps. W. E. Perry and S. Davies. 28,909. December 22nd. (Addition to No. 23,781 of 1911.)

1912.

Electric Switches and Circuits. G. H. Batley and J. M. Bain. 88. January 1st.

Electric-Influence Machines. A. Parfus. 128. January 2nd.

Fusible Cut-Outs. C. M. Dorman, R. A. Smith and H. G. Bagga. 315. January 4th.

Single-Phase Alternating-Current Repulsion Motors. Siemens-Schuckertwerke Ges. 1,250. January 16th. (January 16th, 1911.)

Electric Surface Resistances. C. A. Allison. (Compagnie de l'Industrie Electrique et Mecanique.) 2,028. January 25th.